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NATIONAL DAM SAFETY PROGRAM. CUPSAW LAKE DAM (NJ00194), PASSAIC--ETC(U)
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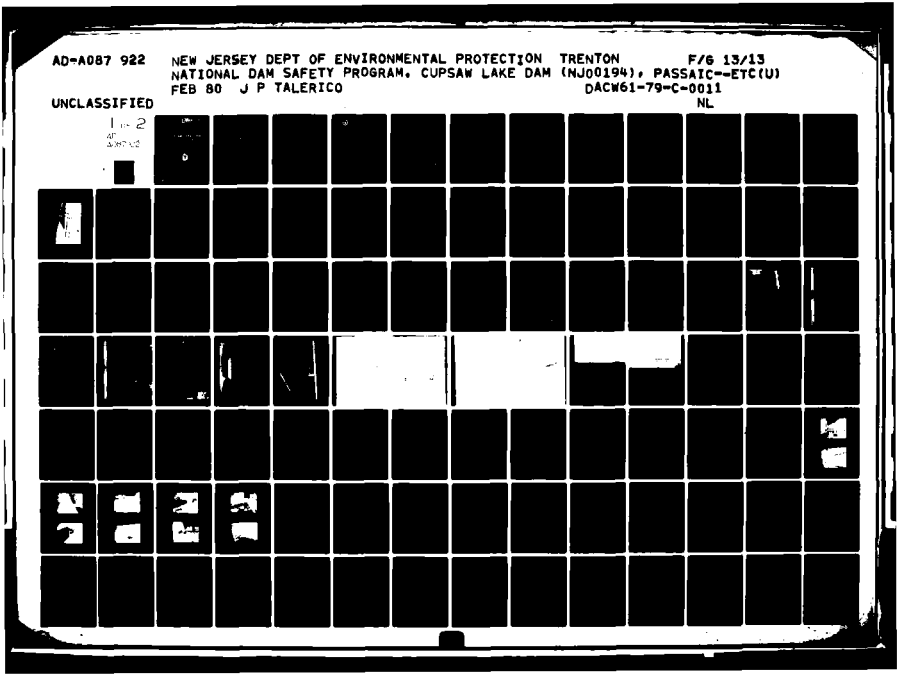

PASSAIC RIVER BASIN
CUPSAW BROOK, PASSAIC COUNTY
NEW JERSEY

CUPSAW LAKE DAM
NJ 00194

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DAC W61-79-C-0011

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

FEBRUARY 1980

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Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams	National Dam Safety Program	Seepage
Embankments	Cupsaw Lake Dam, New Jersey	
Visual Inspection	Spillways	
Structural Analysis	Erosion	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-N

05 AUG 1980

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Cupsaw Lake Dam in Passaic County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Cupsaw Lake Dam, a high hazard potential structure, is judged to be in good overall condition. The dam's spillway is considered inadequate because a flow equivalent to 24 percent of the Probable Maximum Flood would cause the dam to be overtopped. The decision to consider the spillway "inadequate" instead of "seriously inadequate" is based on the determination that dam failure from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. Within twelve months from the date of approval of this report, observation wells or piezometers should be installed in the embankment to determine the location of phreatic surface and the paths of the seepage observed.

c. The following remedial action should be completed within twelve months from the date of approval of this report.

(1). Repair all cracked and spalled concrete, especially on the downstream channel weirs and walls.

(2). All brush and trees should be removed from the downstream and upstream slopes. The embankment face should then be seeded to develop a growth of grass for surface erosion protection.

(3). Investigate the embankment for animal burrows and fill in any burrow holes with impervious material.

d. The flow of seepage should be monitored monthly to determine its volume and whether it presents a problem to the safety of the dam.

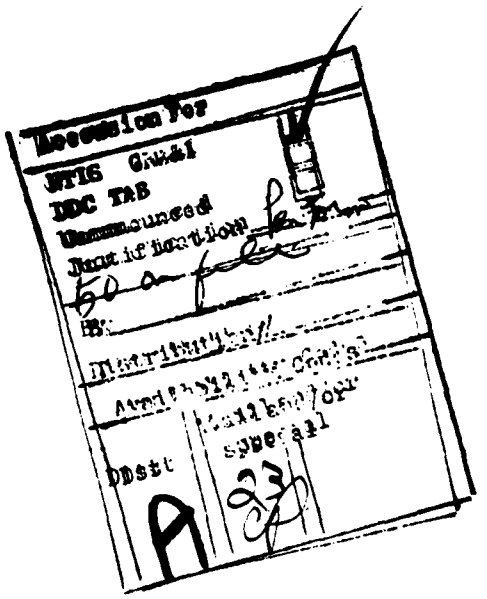
e. Continue monitoring left channel wall to see if there is movement, if so, the wall should be replaced as failure of the wall could result in collapse of Cupsaw Drive.

f. Within two years from the date of approval of this report consider providing additional low-level outlet facilities to decrease drawdown time.

g. Within oe year from the date of approval of this report the owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Roe of the Eighth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.



NAPEN-N
Honorable Brendan T. Byrne

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

CUPSAW LAKE DAM (NJ00194)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 19 November and 3 December 1979 by Harris - ECI Associates, Inc., under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Cupsaw Lake Dam, a high hazard potential structure, is judged to be in good overall condition. The dam's spillway is considered inadequate because a flow equivalent to 24 percent of the Probable Maximum Flood would cause the dam to be overtopped. The decision to consider the spillway "inadequate" instead of "seriously inadequate" is based on the determination that dam failure from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. Within twelve months from the date of approval of this report, observation wells or piezometers should be installed in the embankment to determine the location of phreatic surface and the paths of the seepage observed.

c. The following remedial action should be completed within twelve months from the date of approval of this report.

(1). Repair all cracked and spalled concrete, especially on the downstream channel weirs and walls.

(2). All brush and trees should be removed from the downstream and upstream slopes. The embankment face should then be seeded to develop a growth of grass for surface erosion protection.

(3). Investigate the embankment for animal burrows and fill in any burrow holes with impervious material.

d. The flow of seepage should be monitored monthly to determine its volume and whether it presents a problem to the safety of the dam.

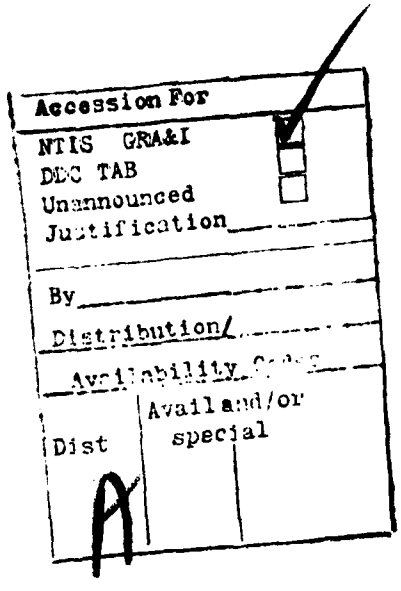
e. Continue monitoring left channel wall to see if there is movement, if so, the wall should be replaced as failure of the wall could result in collapse of Cupsaw Drive.

f. Within two years from the date of approval of this report consider providing additional low-level outlet facilities to decrease drawdown time.

g. Within one year from the date of approval of this report the owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

APPROVED: _____
JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 21 July 1980



PASSAIC RIVER BASIN

CUPSAW BROOK, PASSAIC COUNTY

NEW JERSEY

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CUPSAW LAKE DAM

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PHASE I INSPECTION REPORT.

NATIONAL DAM SAFETY PROGRAM. Cupsaw Lake Dam (NJ00194), Passaic River Basin, Cupsaw Brook, Passaic County, New Jersey.

15) DA W61-[illegible]-C-0044

DEPARTMENT OF THE ARMY

PHILADELPHIA DISTRICT, CORPS OF ENGINEERS

PHILADELPHIA, PENNSYLVANIA 19106

FEBRUARY, 1980

AD A108912

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Name:	Cupsaw Lake Dam, I.D. NJ 00194
State Located:	New Jersey
County Located:	Passaic County
Stream:	Cupsaw Brook
River Basin:	Passaic River
Date of Inspection:	November 19 and December 3, 1979

Assessment of General Conditions

Cupsaw Lake Dam is an earthfill dam containing a main concrete weir spillway, and a auxiliary concrete weir spillway at the left end of the dam. The overall condition of the dam is good. There is no sign of distress or instability in the embankment although there is vertical cracking in the main spillway's right abutment wall. The downstream channel's concrete bottom and wall are cracked and severely spalled. The left channel wall is tilting inward towards the channel. The low-level sluice gate is in operable condition. The hazard potential is rated as "high".

The adequacy of Cupsaw Lake Dam is considered questionable in view of its lack of spillway capacity to pass the SDF (PMF) without overtopping the dam. The spillway is capable of passing a flood equal to 23 percent of the PMF, and is assessed as "inadequate".

At present, the engineering data available is not sufficient to make a definitive statement on the stability of the dam, but based on the findings of the visual inspection, the preliminary assessment of the static stability is that it is satisfactory. The following actions, are recommended along with a timetable for their completion. All recommended actions should be conducted under the supervision of an Engineer who is experienced in the design, construction and inspection of dams.

1. Carry out a more precise hydrologic and hydraulic analysis of the dam within twelve months, to determine the need and the type of mitigating measures necessary. Based on the results of these studies, remedial measures should be instituted. This should include the installation of a tailwater gage.

2. Observation wells or piezometers should be installed in the embankment to determine the location of the phreatic surface and the paths of the seepage observed. This should be done within twelve months.

3. The flow of seepage should be monitored monthly to determine its volume and whether it presents a problem to the safety of the dam.

4. Repair all cracked and spalled concrete especially downstream channel weirs and walls within twelve months.

5. Continue monitoring left channel wall to see if there is movement, if so, the wall should be replaced as failure of the wall could result in collapse of Cupsaw Drive.

6. All brush and trees should be removed from the downstream and upstream slopes to avoid problems which may develop from roots. The embankment face should then be seeded to develop a growth of grass for surface erosion protection. This program should be started within twelve months.

7. Investigate embankment for animal burrows and fill in any burrow holes with impervious material.

8. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.

Furthermore, while of a less urgent nature, the following additional action is recommended and should be carried out within twenty-four months.

1. Consider providing additional low-level outlet facilities to decrease drawdown time.

2. The owner should develop within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.

John P. Talerico

John P. Talerico, P.E.
HARRIS-ECI ASSOCIATES

Photo taken December 3, 1979

C U P S A W L A K E D A M

Main spillway on left and auxiliary spillway, adjacent to main, on right. Embankment is out of photo on viewer's left.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

CUPSAW LAKE DAM, I.D. NJ 00194

S E C T I O N 1

1. PROJECT INFORMATION

1.1 General

a. Authority

The National Dam Inspection Act (Public Law 92-367, 1972) provides for the National Inventory and Inspection Program by the U.S. Army Corps of Engineers. This inspection was made in accordance with this authority under Contract C-FPM No. 35 with the State of New Jersey who, in turn, is contracted to the Philadelphia District of the Corps of Engineers, and was carried out by the engineering firm of Harris-ECI Associates, Woodbridge, New Jersey.

b. Purpose of Inspection

The visual inspection of Cupsaw Lake Dam was made on November 19, 1979. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

The report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

1.2 Description of Project

a. Description of Dam and Appurtenances

Cupsaw Lake Dam is an earthfill dam approximately 430-foot long and 35-foot high with a concrete core wall. There is a 50-foot wide main spillway and a 60-foot wide auxiliary spillway at the left end of the dam. Both spillways are concrete overflows. The crest of the main spillway is 2.85 feet below the top of dam, while the auxiliary spillway crest is 0.25 feet above the main spillway.

The embankment has a top width of 8 feet with upstream and downstream slopes of 2H:1V. Riprap protection has been placed on the upstream face of the embankment. A 4-foot wide bituminous covered concrete sidewalk exists from the main spillway for a distance of approximately 160 feet along the embankment crest. An 8-inch wide concrete curb, extending from the top of core wall to 6 inches above the crest, is along the entire length of the embankment.

The low-level outlet consists of a 24-inch cast iron pipe through the dam approximately 270 feet right of the spillway. The flow through the pipe is controlled by a manually operated gate valve located in the center of the embankment. The inlet end of the pipe is located at upstream toe of the slope and is a concrete chamber with a steel grating cover. The outlet discharges into a stilling basin and then into the downstream channel just before it crosses under Cupsaw Drive.

The downstream spillway channel is 30-foot wide and runs parallel to Cupsaw Drive, approximately 18 feet from the edge of pavement. The channel has a concrete bottom and concrete retaining walls, the left wall retaining the roadway embankment for Cupsaw Drive. Also along the bottom is a series of eleven concrete weirs 25 feet apart. The channel crosses under Cupsaw Drive through a 20-foot by 13-foot concrete opening 370 feet from the spillway.

A wooden plank foot bridge with steel girders spans both spillways. The bridge is supported on the spillway abutment walls, and by steel piered frame support in the middle of the main spillway and flanked by one steel I-beam on each side of the framed support.

A second earthfill dam known as the West Dike exists along the right shoreline of the lake approximately 450 feet from the dam. The dike is approximately 110-foot long and 9-foot high with a concrete core wall. The crest has a top width of 8 feet and the upstream and downstream slopes are 2H:1V. Riprap protection has been placed on the upstream face of the dike.

There are no known records of the test pits taken for this dam.

A generalized description of soil conditions is contained in Report No. 3, Passaic County, Engineering Soil Survey of New Jersey, by Rutgers University. The report, dated 1951, describes the lake area soils as ground moraine deposited during the Wisconsin glaciation. Ground moraine is unstratified, heterogenous material including clay, silt and sand sizes, with varying amounts of gravel, cobbles and boulders. The underlying rock is variable in depth but is usually shallow. Geologic Overlay Sheet 22 describes the rock as Pyroxene Gneiss; mainly quartz-andesine gneiss with both Ortho-and Clino Pyroxene.

b. Location

Cupsaw Lake Dam is located on Cupsaw Brook in the Borough of Ringwood, Passaic County, New Jersey. It is accessible by way of Cupsaw Drive.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams" by the U.S. Department of the Army, Office of the Chief Engineers, the dam is classified in the dam size category as being "intermediate", since its storage area of 1,439 acre-feet is more than 1,000 acre-feet, but less than 50,000 acre-feet. The dam is also classified as "small" because its height of 35.0 feet is less than 40 feet. The overall size classification is governed by the larger of these two determinations, and accordingly, Cupsaw Lake Dam is classified as "intermediate" in size.

d. Hazard Classification

A hazard potential classification of "high" has been assigned to the dam on the basis that a hypothetical failure would result in excessive damage to the road immediately downstream of the dam. Because the road is heavily traveled, the possibility exists of the loss of more than a few lives in the event of dam failure.

e. Ownership

Cupsaw Lake Dam is owned by:

Cupsaw Lake Improvement Association
P.O. Box 205
Ringwood, NJ 07456

Attention: Mr. Gunther Hoffman
(201) 839-6760

f. Purpose

Cupsaw Lake Dam is presently used for recreational purposes only.

g. Design and Construction History

A permit to construct Cupsaw Lake Dam was issued in July 1927, but the construction did not begin until 1930 and was completed in 1931. Seepage was observed in the vicinity of the low-level outlet during an inspection in October 1930. This seepage continued to be reported until May 1932. It was monitored from October 1931 to May 1932 with the flow varying from 114 gpm to 150 gpm. As the seepage was fairly constant and running clear, with no threat to the stability, the dam was accepted in July 1932. Records in the files at NJ-DEP state the owner planned to place grout along the upstream face of the core wall in the fall of 1932 to try and stop the seepage. No other reference is available as to the grouting actually being completed.

In 1963, a permit was issued for the replacement of the left abutment of the spillway, but the work was never done.

During the May 1968 flood, the water reached 3.5 feet above the spillway, overtopping the dam and the West Dike causing damage to the residences at the West Dike, and eroding the crest of the dike.

In 1973, Cupsaw Lake Dam was modified by adding the auxiliary spillway and raising the embankment crest. In addition, the West Dike was repaired and the crest also raised to approximately one foot above the dam.

h. Normal Operating Procedures

The discharge from the lake is unregulated and is allowed to naturally balance the inflow into the lake. The low level outlet is used to lower the lake level to allow property owners to make repairs to their docks and waterfront property.

1.3 Pertinent Data

a. Drainage Area	4.2 sq. mi.
b. Discharge at Dam Site	
Ungated spillway capacity at elevation of top of dam:	2,599 cfs (391.2 NGVD)
Total spillway capacity at maximum pool elevation (SDF):	19,653 cfs (396.41 NGVD)
c. Elevation (Feet above NGVD)	
Top of dam:	391.2
Maximum pool design surcharge (SDF):	394.88
Recreation pool:	388.0 ±
Spillway crest:	387.35
Streambed at centerline of dam:	345.0 (estimated)
Maximum tailwater:	-
d. Reservoir	
Length of maximum pool:	5,000 ft. (estimated)
Length of recreation pool:	4,500 ft. (estimated)
e. Storage (acre-feet)	
Spillway Crest:	698
Top of dam:	984
Maximum pool (SDF):	1,439
f. Reservoir Surface (acres)	
Top of dam:	81 (estimated)
Maximum pool (SDF):	92 (estimated)
Recreation pool:	N/A
Spillway crest:	69 (387.35 NGVD)

g. Dam

Type:	Earthfill with concrete weir
Length: (overall)	430 ft. (effective)
Height:	35 ft.
Top width:	8 ft.
Side slopes - Upstream:	2H:1V
- Downstream:	2H:1V
Zoning:	Unknown
Impervious core:	Concrete core wall
Cutoff:	None
Grout curtain:	None

h. Diversion and Regulating Tunnel

N/A

i. Spillway

Type - Main and Auxiliary:		Ungated concrete weir overflow
Length of weir -	Main:	50 ft.
	Auxiliary:	60 ft.
Crest elevation -	Main:	387.35 NGVD
	Auxiliary:	387.60 NGVD
Gates:		None
U/S Channel:		Cupsaw Lake
D/S Channel:		30-ft. wide side spillway with ladder or energy dissipator

j. Regulating Outlets

Low level outlet:	24-inch C.I.P.
Controls:	Manually operated outlet gate valve
Emergency gate:	None
Outlet:	351.0 NGVD (estimated)

SECTION 2

2. ENGINEERING DATA

2.1 Design

Drawings for the original construction in 1931 and the modifications in 1973 are available at the Trenton offices of the N.J. Department of Environmental Protection (NJ-DEP). One drawing (Plate 7), from the 1931 set, shows foundation test pits along the dam base. No further embankment data from soil borings, soil tests, design computations, or other geotechnical data are available to assess the embankment stability properly. A stability analysis for the proposed 1963 reconstruction of the left abutment is on file at NJ-DEP. No other data relating to the stability of the other walls is available. Some data concerning the hydraulic capacity of the spillway is available.

2.2 Construction

Data is not available concerning the as-built construction of the dam. No data exists of construction methods, borrow sources, or other data pertinent to the construction of the dam.

2.3 Operation

Formal operation records are not kept for the dam and reservoir. The lake is allowed to operate naturally without regulation.

2.4 Evaluation

a. Availability

The availability of engineering data is poor. The stated drawings computations and some correspondence concerning the original construction and the modifications are available from the NJ-DEP.

b. Adequacy

The engineering data available, together with that obtained in the field, were adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform a stability analysis, but preliminary evaluation could be made based on visual observations.

c. Validity

The dam and spillway appear to correspond to the drawings, but the provision for a foot bridge over the spillway is not shown, and the low-level outlet pipe is given as a 12-inch C.I.P. instead of a 24-inch pipe.

SECTION 3

3. VISUAL INSPECTION

3.1 Findings

a. General

The visual inspection of Cupsaw Lake Dam revealed the dam including the two spillways (main and auxiliary) to be in good condition but in need of repairs. The lake level was above the main spillway's crest at the time of inspection.

b. Dam

The earth embankment appears to be sound. The concrete curb (top portion of core) that runs along the upstream face of the embankment is in good condition. There is some vertical movement that has caused minor random cracking of the bituminous-covered concrete sidewalk that runs along the crest of the embankment. Otherwise, no misalignment of the embankment's vertical plane was observed. No misalignment of the embankment's horizontal plane was noted. Erosion of the embankment is minor. No riprap failures were noted. Minor seepage was observed along a 50 foot section of the embankment toe, beginning approximately 20 feet right of the main spillway. The exact location of the seepage could not be determined because this 50 foot area was covered with scrub brush and leaves. Trees of all sizes are growing along the downstream side while vegetation and brush are growing on both sides and top of the embankment. No evidence of burrowing by animals was observed; however at the time of the inspection the embankment was masked by trees, vegetation and brush growth, therfore the possibility does exist that there may be burrow holes in the embankment.

In addition to the embankment described above, there is a small dike on the southwest shore of the lake. This dike is in good overall condition with no sign of any distress.

c. Appurtenant Structures

1. Spillways

There are two spillways - the main and the auxiliary. The auxiliary is adjacent to and left of the main spillway. Both spillways are in good condition. The main spillway shows a crack in its right abutment wall but, in general, the concrete is in good condition. The vertical and horizontal alignment of the crests are good. Slight leakage is occurring where the auxiliary spillway meets its left abutment wall. Slight leakage is also occurring at the joint between the auxiliary spillway and its right abutment.

2. Bridge and Piers

The concrete abutments of the dam, a steel framed pier support, and two I-beams support a wooden walkway that spans both spillways. The bridge and piers are in good condition.

3. Outlet Works

A 24-inch cast iron pipe through the dam serves as its low-level outlet. Its valve is located in a pit covered by a manway cover with extended stem protruding through concrete pad adjacent to the manway. Water was a few feet over the valve and, therefore, inspection was impossible. The extended stem replaced a chain wheel operator, a modification made 4 years ago. The valve operated satisfactorily during demonstration.

d. *Reservoir Area*

Houses, boat landings and trees circle the lake. The side slopes of the lake are flat. However, in some areas, shallow concrete walls appear to contain the slopes. The lake was clear with no growth of algae.

e. Downstream Channel

The downstream channel is contained within two concrete retaining walls. A series of concrete weirs, abutting and perpendicular to the walls, run along the length of the channel. The walls and weirs show evidence of decay. The four upper weirs are seriously cracked and spalled. The right wall is cracked and spalled, and the left is tilting inward under the lateral thrust of the Cupsaw Drive. The owner has had the left wall monitored for the past ten years and, he stated that the wall is presently stable. The channel crosses under Cupsaw Drive approximately 75 feet from the dam.

An abandoned gas station is on the right side of the channel, approximately 100 feet from the dam or at the southwest corner of Cupsaw Drive overpass with the channel.

SECTION 4

4. OPERATIONAL PROCEDURES

4.1 Procedures

Cupsaw Lake Dam is used to impound water for recreational activities. The level of the lake is maintained through the unregulated flow over the spillway. The lake is not lowered on a regular basis, but is periodically lowered in the fall to allow property owners to make repairs to their properties.

4.2 Maintenance of the Dam

There is no regular inspection and maintenance program for the dam and appurtenant structures. The Cupsaw Lake Improvement Association is responsible for the maintenance of the dam.

4.3 Maintenance of Operating Facilities

The low-level outlet operating facilities consist of the one manually operated 24-inch gate valve. At the time of inspection, operation of the valve was satisfactorily demonstrated.

4.4 Evaluation

The present operational and maintenance procedures are fair with the dam and spillway being maintained in a serviceable condition.

SECTION 5

5. HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The drainage area above Cupsaw Lake Dam is approximately 4.2 square miles. A drainage map of the watershed of the dam site is presented in Plate 1, Appendix D.

The topography within the basin is moderately sloped. Elevations range from approximately 1,100 feet above NGVD at the southeast end of the watershed to about 388 feet at the dam site. Land use patterns within the watershed are mostly woodland with concentrated residential development around the lake area.

The evaluation of the hydraulic and hydrologic features of the dam and lake was based on criteria set forth in the Corps' Guidelines and additional guidance provided by the Philadelphia District, Corps of Engineers. The Spillway Design Flood (SDF) for the dam is equal to the PMF.

The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation using Hydrometeorological Report No. 33 with standard reduction factors. Due to the small drainage area, the SCS triangular hydrograph transformed to a curvilinear hydrograph was adopted for developing the unit hydrograph, with the aid of the HEC-1-DB Flood Hydrograph Computer Program.

Initial and infiltration loss rates were applied to the Probable Maximum Precipitation to obtain rainfall excesses. The rainfall excesses were applied to the unit hydrograph to obtain the PMF and various ratios of PMF utilizing program HEC-1DB.

The SDF peak outflow calculated for the dam is 13,686 cfs. This value is derived from the PMF, and results in overtopping of the dam, assuming that the lake was originally at the spillway crest elevation.

The stage-outflow relation for the spillway was determined from the geometry of the spillway and dam, utilizing HEC-1-DB program.

The reservoir stage-storage capacity relationship was computed directly by the conic method, utilizing the HEC-1-DB program. The reservoir surface areas at various elevations were measured by planimeter from a U.S.G.S. Quadrangle topographic map. Reservoir storage capacity included surcharge levels exceeding the top of the dam, and the spillway rating curve was based on the assumption that the dam remains intact during routing.

A breach analysis indicates that the stage of the stream where it crosses Cupsaw Drive is 5.8 feet higher, due to dam failure from overtopping at 50 percent PMF than it would be without failure at 50 percent PMF. This is likely to jeopardize the well traveled road, but not significantly more than without failure.

Drawdown calculations indicate that to empty the lake to an elevation of 357.0 NGVD through the one low-level outlet would take 6.0 days, assuming a 2 cfs/square mile inflow. This is considered to be an excessive drawdown period, and provision of additional outlets should be considered.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site.

c. Visual Observation

The downstream channel is contained between two concrete retaining walls. A series of concrete weirs abutting and perpendicular to the walls run along the channel. The walls are vertical and the left wall retains the embankment for Cupsaw Drive. The roadway bridge for Cupsaw Drive crosses the channel approximately 370 feet downstream of the spillway and approximately 75 feet from the embankment. An abandoned gas station is on the right side of the channel on the southwest corner of Cupsaw Drive where it crosses the channel.

The slopes of the reservoir are flat and do not exhibit signs of instability. The drainage area is wooded, moderately flat sloped and developed for residential use around the lake.

d. Overtopping Potential

A storm of magnitude equivalent to the SDF would cause overtopping of the dam to a height of 5.21 feet. Computations indicate that the dam can pass approximately 20 percent of the PMF without overtopping the dam crest. Since the PMF is the Spillway Design Flood (SDF) for this dam, according to the Recommended Guidelines for Safety Inspection of Dams by the Corps of Engineers, the spillway capacity of the dam is assessed as "inadequate".

SECTION 6

6. STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There are no major signs of distress in the embankment of Cupsaw Lake Dam. There is random cracking of the sidewalk on the crest. Minor seepage was observed along a 50-foot section of the embankment toe, beginning approximately 20 feet right of the main spillway. Trees growing on the downstream slope and bushes on the crest and upstream slope could pose a threat to stability. Burrow holes were not observed. However, it is possible some could exist but were obscured by leaf cover. Both spillways are in good condition but there is a crack in the right abutment wall of the main spillway. The concrete weirs of the downstream channel are severely cracked and spalled as well as both retaining walls. The left wall in addition is tilting in toward the channel. The wooden plank bridge and piers are in good condition.

b. Design and Construction Data

Design computations relating to the stability of the proposed reconstruction of the left abutment wall are on file at the NJ-DEP. No other design computations relating to stability were uncovered during the report preparation phase. No embankment or foundation soil parameters are available for carrying out a conventional stability analysis on the embankment. No construction data or specifications relating to the degree of embankment compaction are available for use in the stability analysis.

c. Operating Records

No operating records are available relating to the stability of the dam. The dam, dike and spillway have served satisfactorily since the modifications in 1973.

d. Post-Construction Changes

The crest of the dam embankment and the West Dike were raised and an auxiliary spillway was constructed in 1973.

e. Static Stability

A static stability analysis was not performed for Cupsaw Lake Dam because the lack of data on which to base assumptions of material properties within embankment zones might produce misleading results. The recommended remedial actions must be implemented in order to decrease the risk of local failure, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory.

f. Seismic Stability

The dam is located in Seismic Zone 1, as defined in Recommended Guidelines for Safety Inspection of Dams, prepared by the Corps of Engineers. In general, projects located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory and conventional safety margins exist. Since static stability factors have not been confirmed, it cannot be stated that seismic stability is satisfactory.

SECTION 7

7. ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety

The dam has been inspected visually and a review has been made of the available engineering data. This assessment is subject to the limitations inherent in the visual inspection procedures stipulated by the Corps of Engineers for a Phase I report.

The safety of Cupsaw Lake Dam is in question because the dam does not have adequate spillway capacity to pass the SDF (PMF) without overtopping. Overtopping of the dam carries with it the danger of possible progressive failure of the dam. The present spillway capacity of the dam is approximately 23 percent of the PMF.

No definitive statement pertaining to the safety of the embankment can be made without acquisition of embankment material engineering properties and determination of phreatic levels in the downstream part of the embankment, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory.

b. Adequacy of Information

The information uncovered was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform even an approximate computation of the stability of the dam. A preliminary assessment of the dam could be made by visual observation only.

c. Urgency

Carry out a more precise hydrologic and hydraulic analysis of the dam within twelve months, to determine the need and type of mitigating measures necessary. If required, conduct a study of the means of increasing spillway discharge capacity and develop alternative schemes for construction. This should include the installation of headwater and tailwater gages. The ability of the dam to withstand overtopping should also be studied.

Observation wells or piezometers should be installed in the embankment to determine the location of the phreatic surface. The borings should be logged according to the Unified Soil Classification system by qualified personnel and samples taken to determine the values of pertinent soil parameters for stability. This information should be obtained within six months, and should be evaluated immediately upon acquisition to perform stability analyses in accordance with Chapter 4.4 of the Corps' Guidelines.

The existing dam plans and drawings should be annotated and updated to form a coherent as-built set within 24 months.

7.2 Remedial Measures

a. Alternatives for Increasing Spillway Capacity

Alternatives for increasing spillway capacity are as follows:

1. Increase the embankment height of both the dam and the West Dike thus permitting a higher discharge to pass over the spillway and reducing the possibility of overtopping.

2. Lower the spillway crest elevation.

3. Increase the effective spillway crest length.

4. A combination of any of the above alternatives.

b. Recommendations

1. Repair all cracked and spalled concrete especially downstream channel weirs and walls within twelve months.

2. Continue monitoring left channel wall to see if there is movement, if so, the wall should be replaced as failure of the wall could result in collapse of Cupsaw Drive.

3. All brush and trees should be removed from the downstream and upstream slopes to avoid problems which may develop from roots. The embankment face should then be seeded to develop a growth of grass for surface erosion protection. This program should be started within 12 months.

4. Investigate embankment for animal burrows and fill in any burrow holes with impervious material.

The following additional actions are recommended:

1. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.

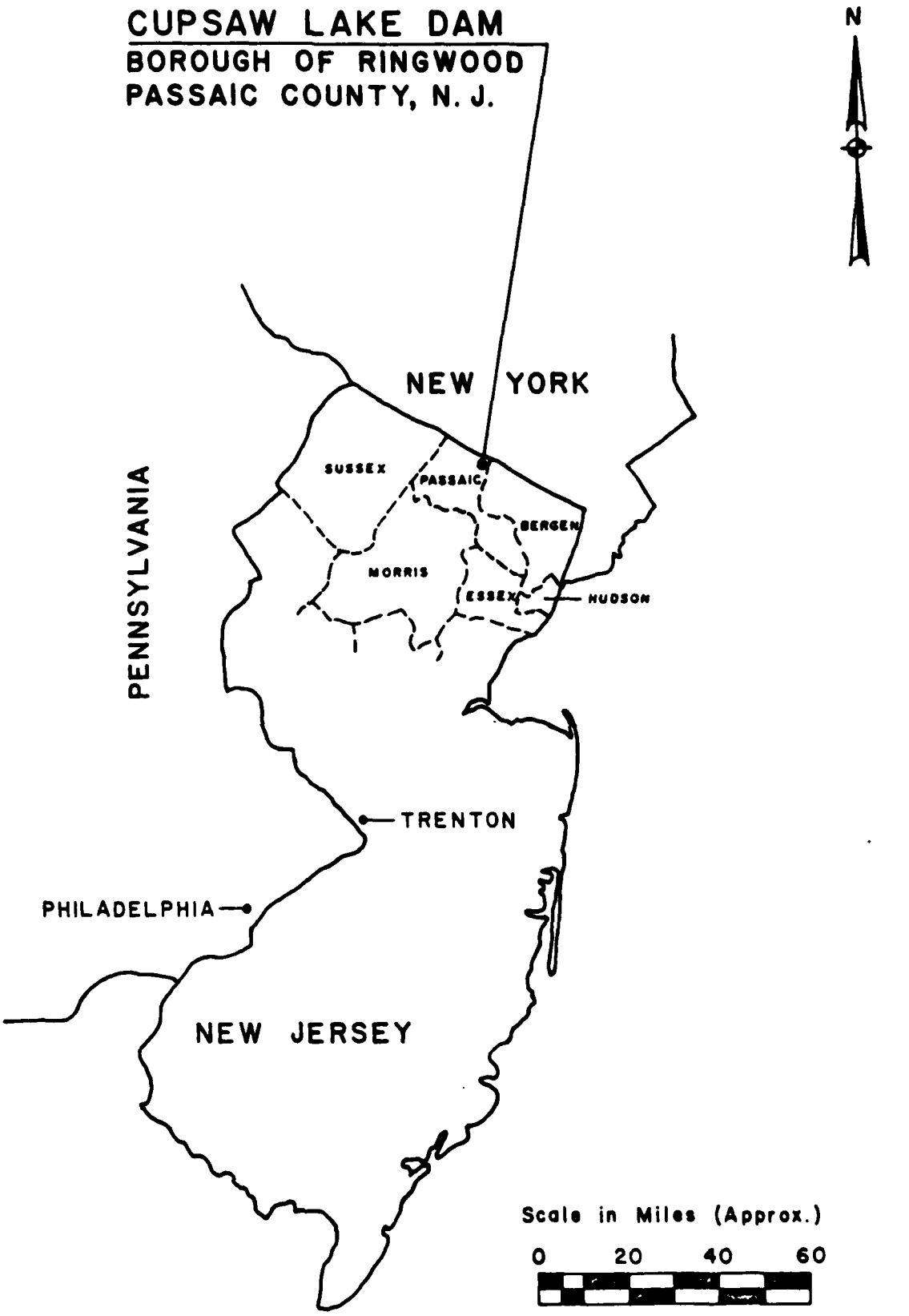
2. Consider providing additional low-level outlet facilities, to decrease drawdown time.

c. O & M Procedures

The owner should develop, within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.

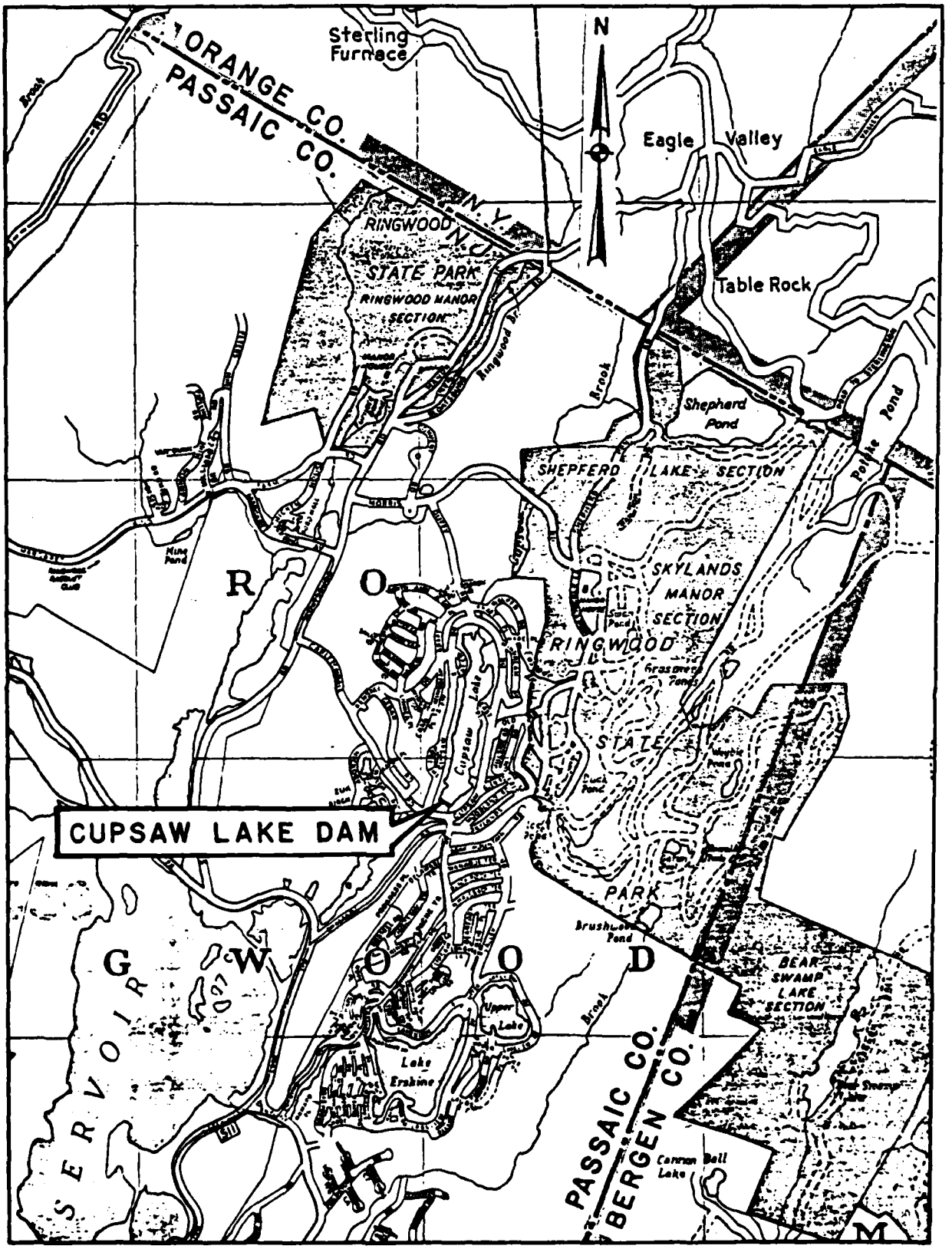
PLATES

CUPSAW LAKE DAM
BOROUGH OF RINGWOOD
PASSAIC COUNTY, N. J.



KEY MAP

PLATE 1

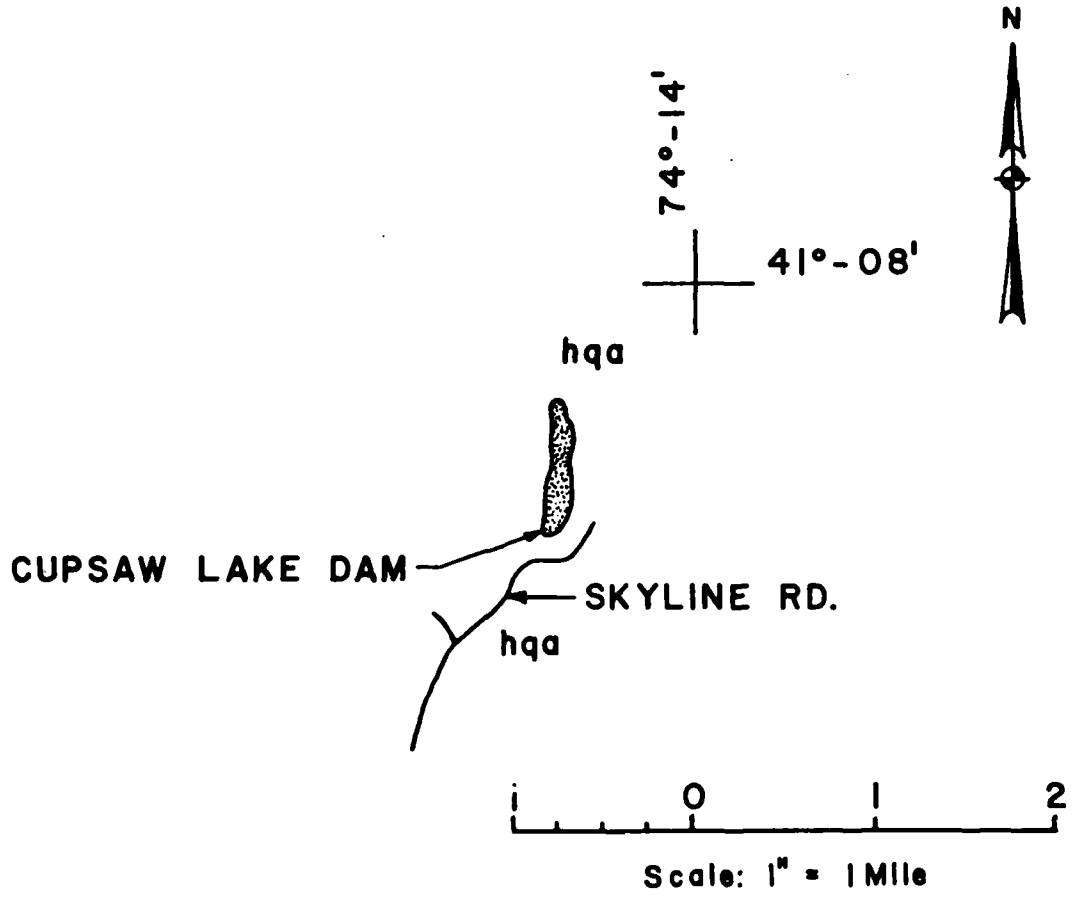


Scale in Feet (Approx.)

2,000 0 2,000 4,000 6,000 8,000 10,000

VICINITY MAP

PLATE IA



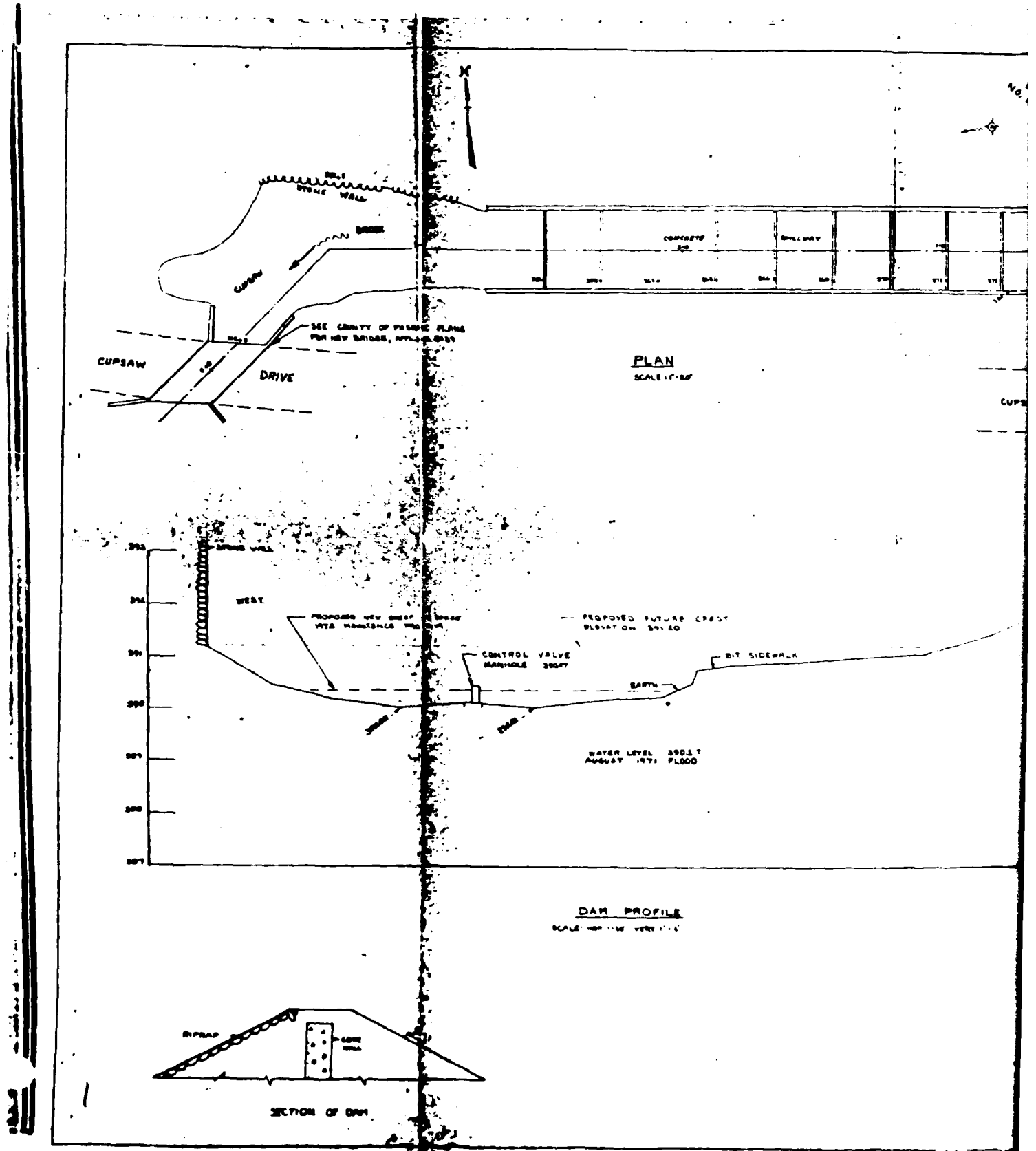
LEGEND:

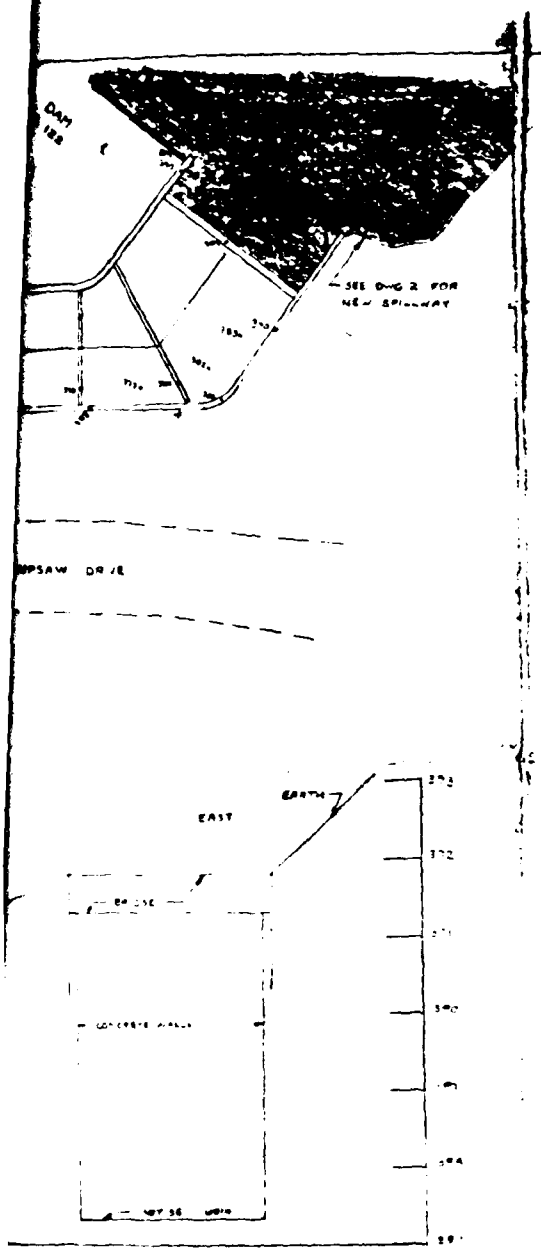
PRECAMBRIAN

hqa Pyroxene Gneiss; mainly Quartz-Andesine Gneiss with both Ortho- and Clinopyroxene

GEOLOGIC MAP
CUPSAW LAKE DAM

PLATE 2


STONE WALL
BRIDGE
CURBING
SEE CRAWTY OF PASSAIC PLANS
FOR NEW BRIDGE, APPLIED 1933
CUPSAW
DRIVE
PLAN
SCALE 1"=20'
CONCRETE
SPILLWAY
CUPS
STONE WALL
WEST
PROPOSED NEW CREST
WITH REMOVABLE
PROPOSED FUTURE CREST
ELEVATION 391.20
CONTROL VALVE
MANHOLE
BIT SIDEWALK
EARTH
WATER LEVEL 390.3 ?
AUGUST 1971 FLOOD
DAM PROFILE
RIPRAP
SECTION OF DAM



LOCATION PLAN

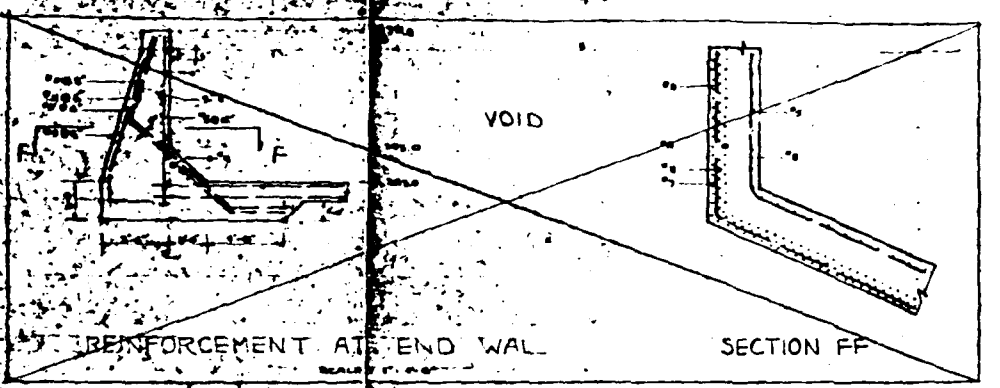
CUPSAW LAKE
IMPROVEMENT ASSOCIATION

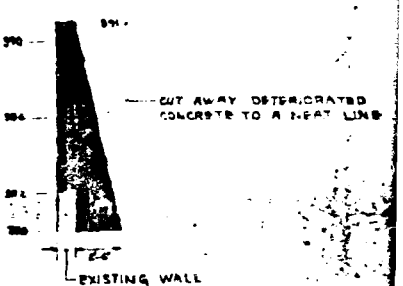
RINGWOOD BOROUGH, PASSAIC COUNTY, NEW JERSEY

FACILITY IMPROVEMENTS

BARNETT & HERENCHAK, INC.
CONSULTING ENGINEERS
NEWARK, NEW JERSEY

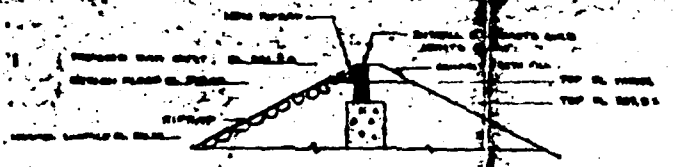
PLATE 3



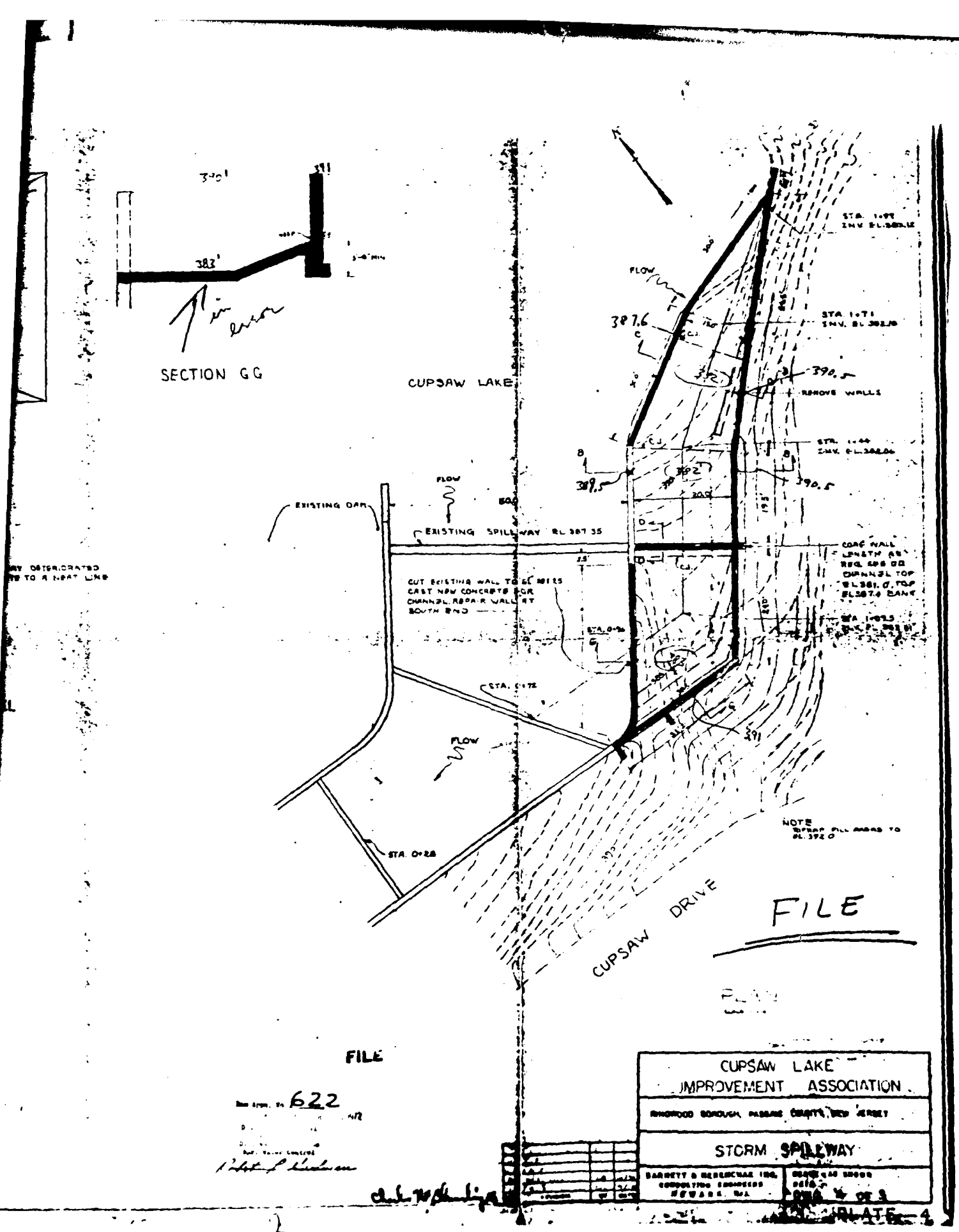


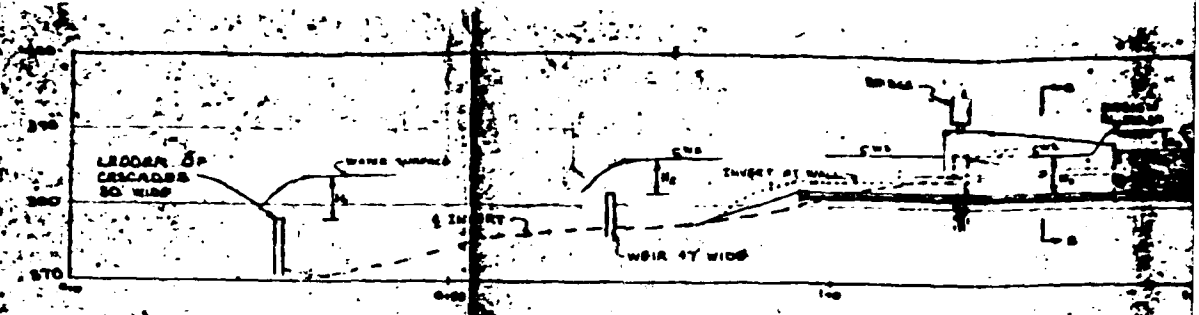
SOUTH END WALL

SLAB JOINT DETAIL



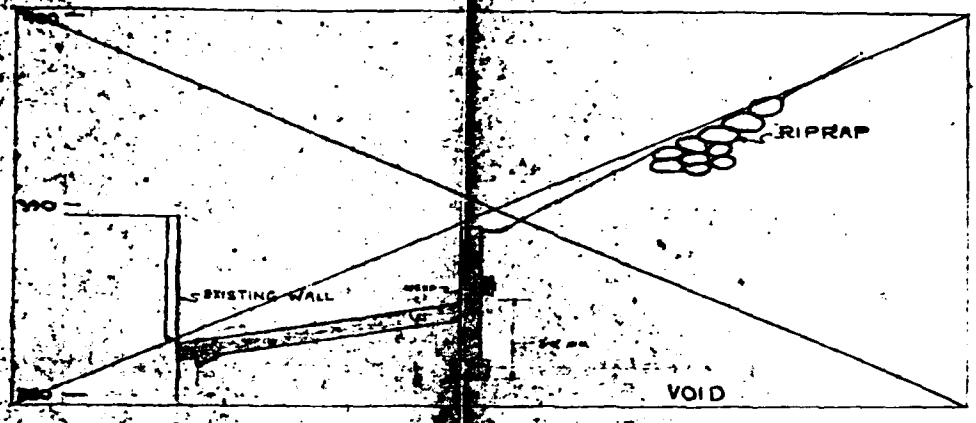
SECTION OF DAM


SECTION G G
CUPSAW LAKE
EXISTING DAM
EXISTING SPILLWAY EL 387.35
FLOW
CUT EXISTING WALL TO BE REMOVED CAST NEW CONCRETE FOR CHANNEL REPAIR WALL AT SOUTH END
REMOVE WALLS
CONC WALL
NOTE
CUPSAW DRIVE
FILE
FILE
CUPSAW LAKE IMPROVEMENT ASSOCIATION
STORM SPILLWAY
PLATE 4



SPILLWAY PROFILE

SCALE 1"=10'-0"



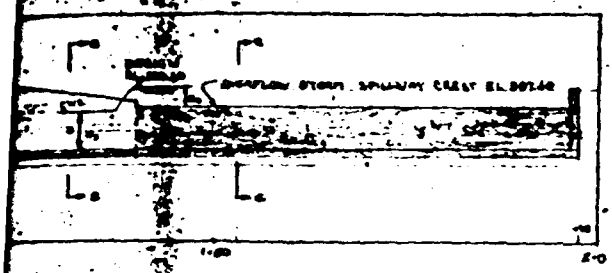
SECTION AA

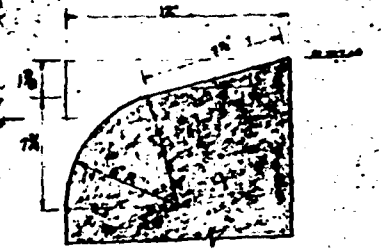
SCALE 1"=5'-0"

SECTION IN ROCK

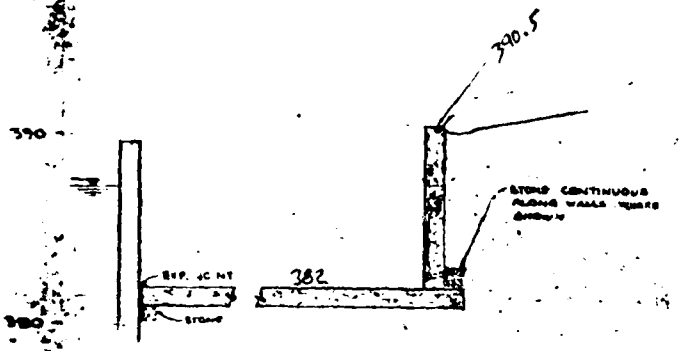
NOTES

1. EXPANSION JOINT ASTM D 33-70
2. CONCRETE - 5000 PSI ASTM C 172-68, TYPE II A
3. STEEL REINFORCEMENT ASTM A 615-68 GRADE 60
4. CRUSHED STONE ASTM D 448-70 3/4" NOM. SIZE



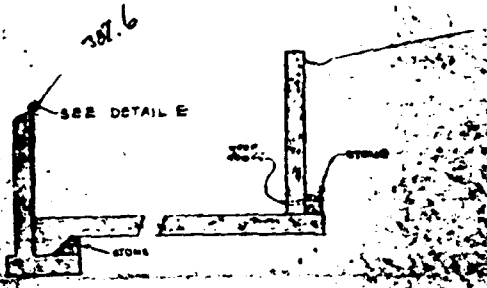


DETAIL E



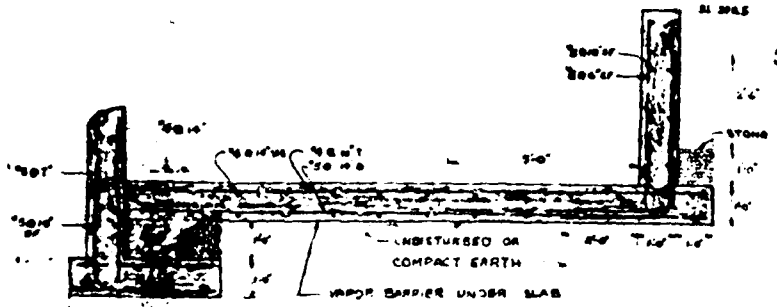
SECTION BB

SCALE 1/4"-1'-0"

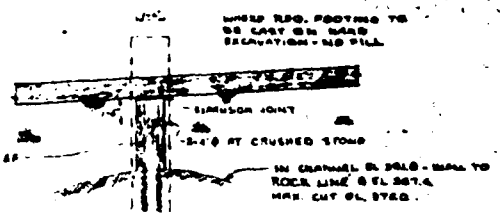


SECTION CC

SCALE 1/4"-1'-0"



REINFORCEMENT DETAILS

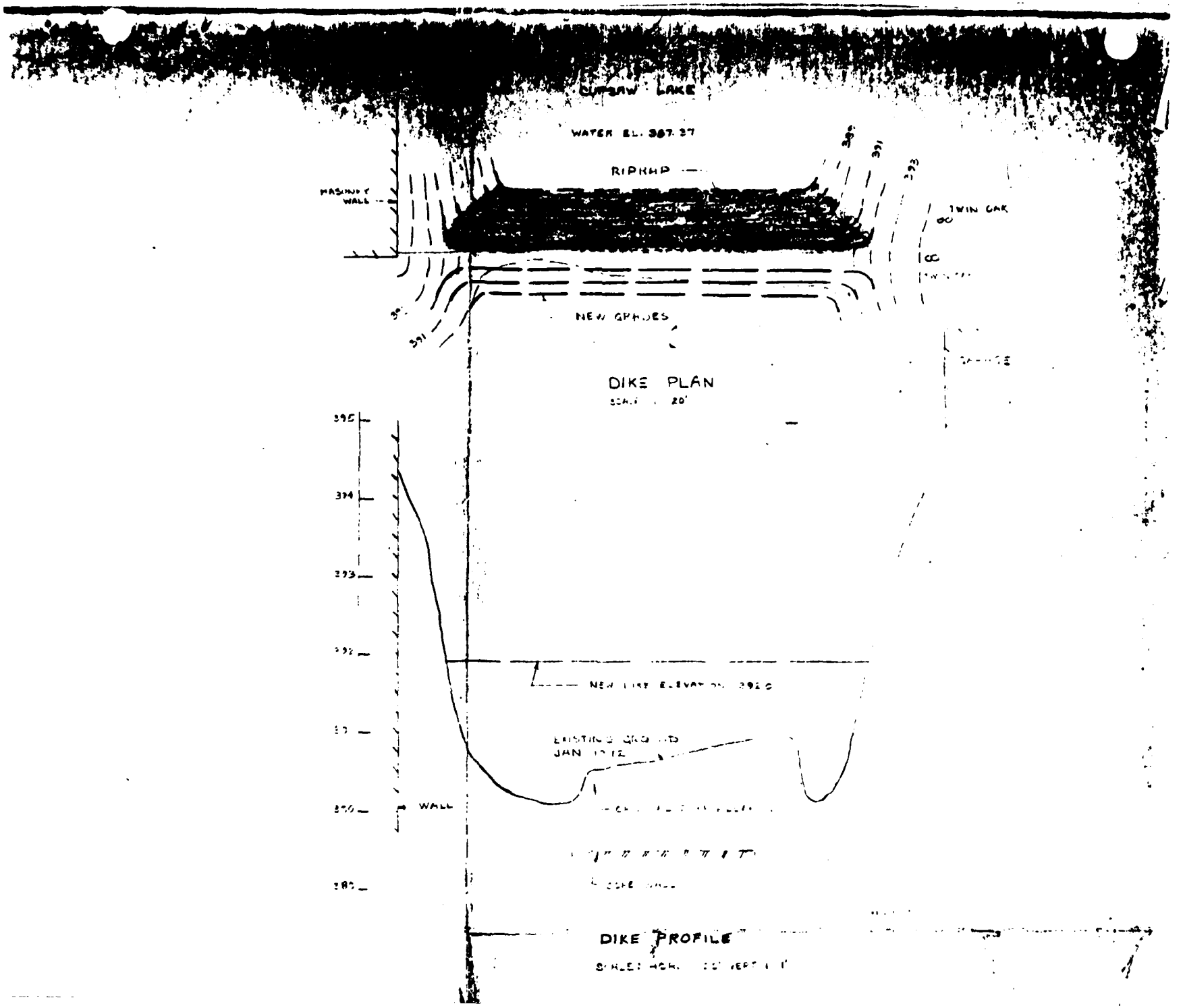


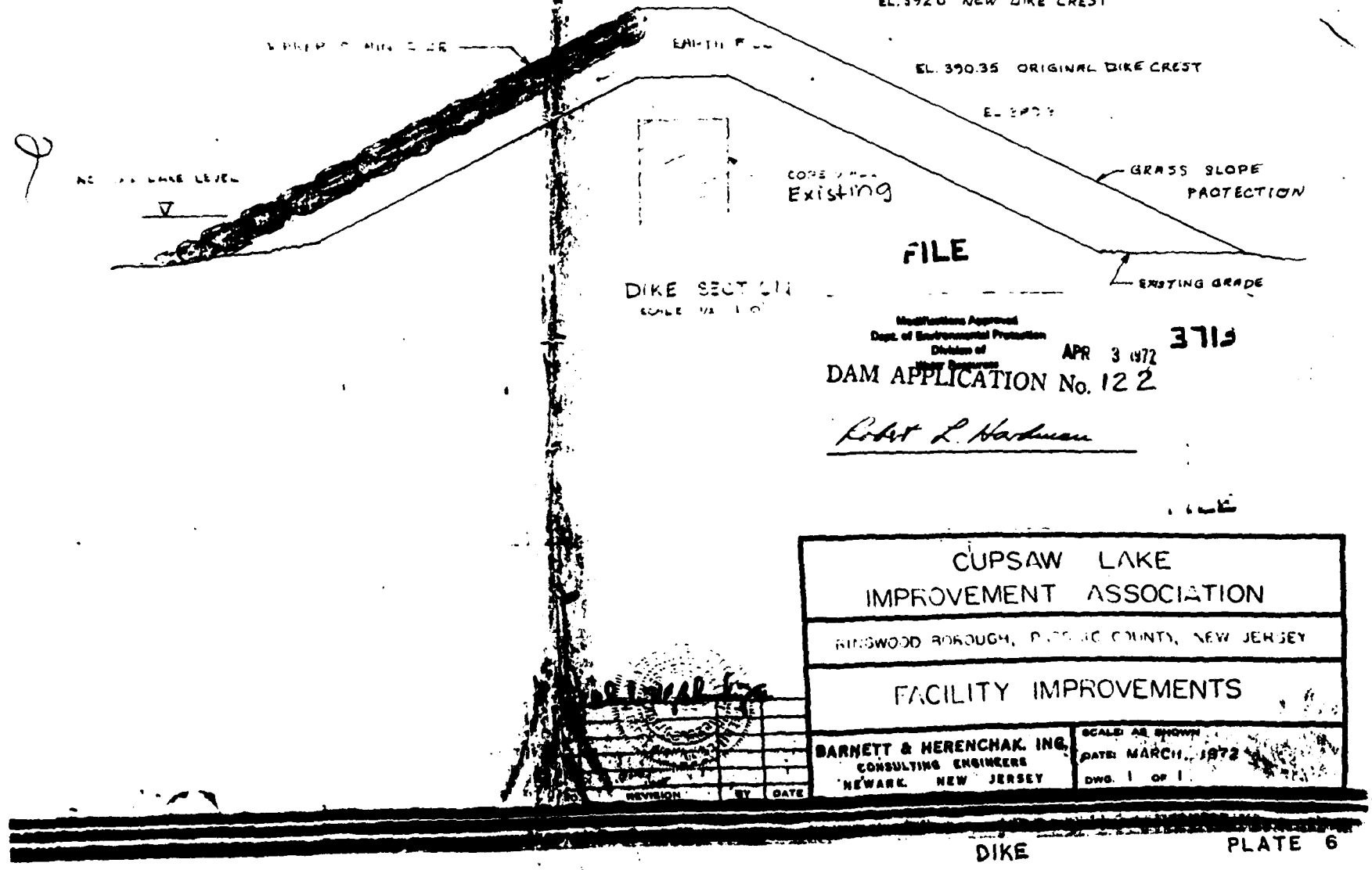
CORE WALL DD

FILE

622

CUPSAW LAKE
IMPROVEMENT ASSOCIATION


WATER EL. 387.37
RIPRAP
391
393
TWIN OAK
NEW GRADES
DIKE PLAN
394
393
392
390
WALL
DIKE PROFILE



FILE

Modifications Approved
Dept. of Environmental Protection
Division of
Water Resources
APR 3 1972

3715

DAM APPLICATION No. 122

Robert L. Hardman

CUPSAW LAKE
IMPROVEMENT ASSOCIATION

RINGWOOD BOROUGH, PASSAIC COUNTY, NEW JERSEY

FACILITY IMPROVEMENTS

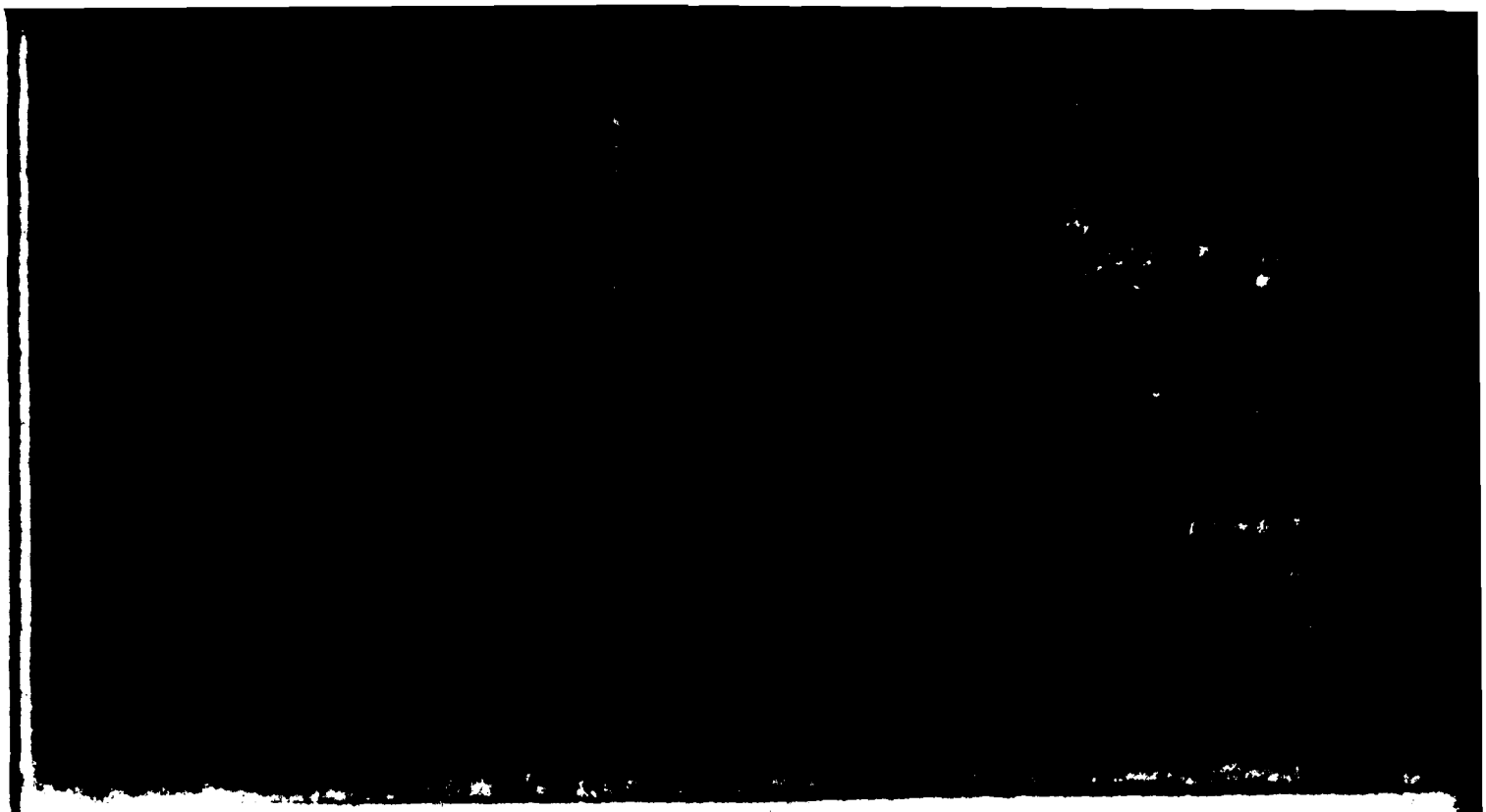
BARNETT & HERENCHAK, INC.
CONSULTING ENGINEERS
NEWARK, NEW JERSEY

SCALE AS SHOWN
DATE: MARCH, 1972
DWG. 1 OF 1

REVISION | BY | DATE

DIKE

PLATE 6



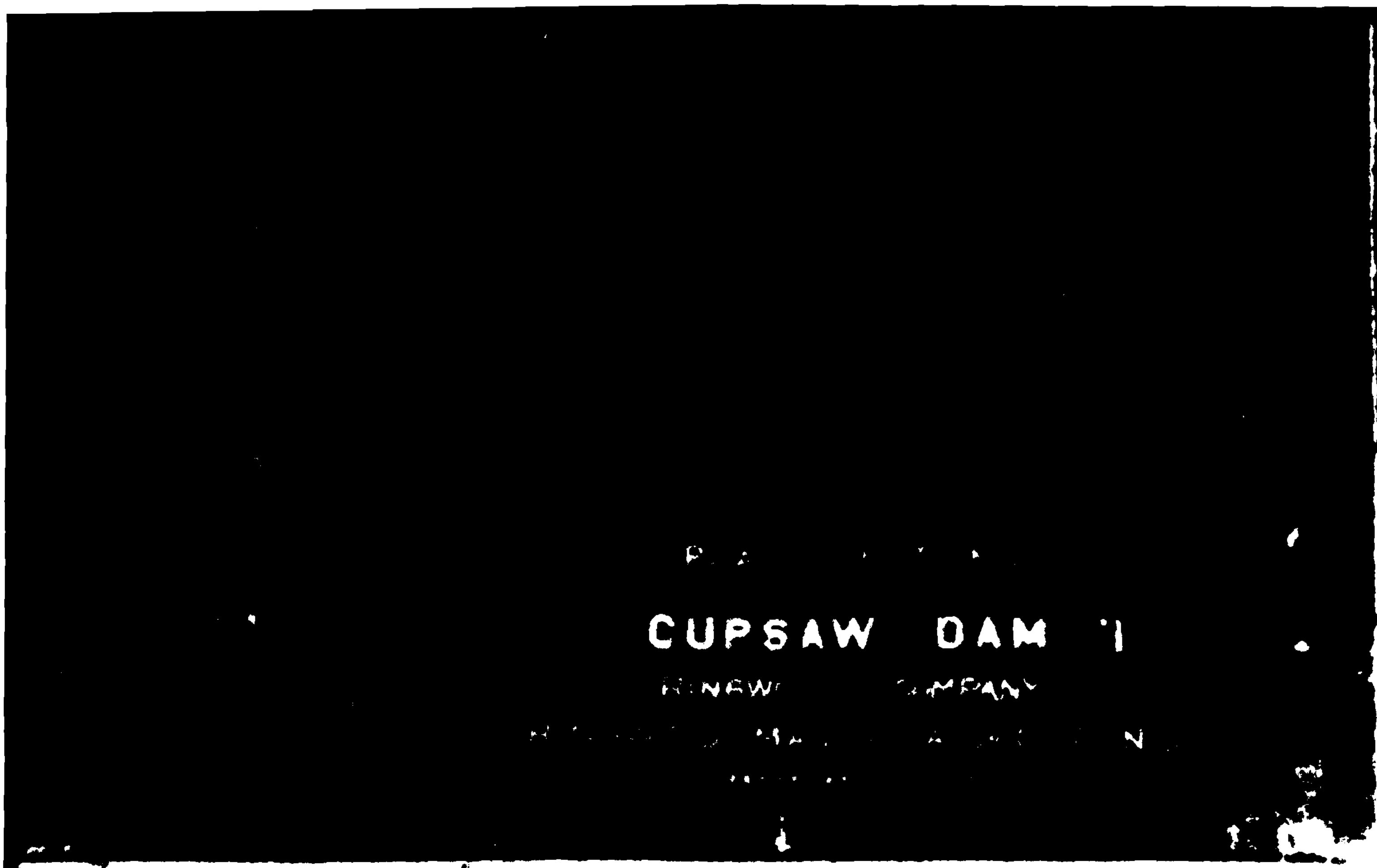


PLATE 7

6

APPENDIX A

CHECK LIST - VISUAL OBSERVATIONS

CHECK LIST - ENGINEERING, CONSTRUCTION MAINTENANCE DATA

CHECK LIST
VISUAL INSPECTION
PHASE 1

Name Dam CUPSAW LAKE DAM County Passaic State New Jersey Coordinators NJ-DEP

Date(s) Inspection November 19, 1979
December 3, 1979
Weather Clear Temperature 54°F

Pool Elevation at Time of Inspection 387.5 NGVD Tailwater at Time of Inspection 357 NGVD

Inspection Personnel:

November 19, 1979:

Chuck Chin
Henry King(Recorder)
Thomas Lakovich

December 3, 1979:

Eugene Koo
James McCormick

OWNER/REPRESENTATIVE:

November 19 and December 3, 1979

Edward Zangara, Maintenance
Cupsaw Lake Improvement Association
P.O. Box 205
Ringwood, NJ 07456

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SEEPAGE OR LEAKAGE N/A		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS N/A		
DRAINS N/A		
WATER PASSAGES N/A		
FOUNDATIONS N/A		

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES N/A		
STRUCTURAL CRACKING N/A		
VERTICAL AND HORIZONTAL ALIGNMENT N/A		
MONOLITH JOINTS N/A		
CONSTRUCTION JOINTS N/A		

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS	Minor random cracking of bituminous - covered concrete sidewalk that runs along embankment crest.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No visible movement or cracking at or beyond toe was noticed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Minor erosion of embankment was visible.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Good. Very minor vertical misalignment at locations of the random cracking of the bituminous-covered concrete sidewalk.	
RIPRAP FAILURES	None.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
Earth embankment has trees, all sizes, growing along the downstream side. Vegetation and brush are growing on top of and on both sides of the embankment.		Remove trees.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM No differential settlement was noted.		
ANY NOTICEABLE SEEPAGE There is minor seepage. It begins at a point approximately 20 feet from the right abutment and continues along the embankment for a distance of approximately 50 feet. This 50 feet in length was covered with scrub brush and leaves so that the exact location of seepage could not be determined.		Remove scrub brush. Monitor seepage.
STAFF GAGE AND RECORDER None.		
DRAINS None.		

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN STILLING BASIN	Surface of stilling basin of low level outlet under water. Not visible.	
INTAKE STRUCTURE	Low level drain under water in lake. Not visible.	
OUTLET STRUCTURE	Low-level drain (24-inch cast iron pipe) has concrete headwall. Good condition. The valve operated satisfactorily during demonstration.	
OUTLET FACILITIES	None.	
EMERGENCY GATE	None	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR	Two spillways exist - the main and the auxiliary. Both are in good condition. There is minor leakage at the joint of the auxiliary spillway with its right abutment.	
APPROACH CHANNEL	Reservoir.	
DISCHARGE CHANNEL	Both in good condition. Some debris in main spillway. Some vegetation growing in auxiliary spillway.	Remove debris and vegetation.
BRIDGE AND PIERS	Two steel I-beam piers and a steel-framed pier support a wooden walkway that spans both spillways. Bridge and piers in good condition.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE SILL N/A		
APPROACH CHANNEL N/A		
DISCHARGE CHANNEL N/A		
BRIDGE AND PIERS N/A		
GATES AND OPERATION EQUIPMENT N/A		

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
MONUMENTATION/SURVEYS None.		
OBSERVATION WELLS None.		
WEIRS None.		
PIEZOMETERS None.		
OTHER None.		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SLOPES Flat. No indication of slope instability.		
SEDIMENTATION None noticed.		

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.) Channel is flanked with vertical concrete walls. A number of concrete weirs perpendicular to and abutting the walls, run along the length of the channel. Four weirs are seriously cracked and spalled. The right wall is cracked and spalled. The left wall is cracked and tilting inward, toward channel, under thrust of Cupsaw Drive.		Repair cracks and spalling. The owner has had left wall monitored for past 10 years with wall being stable. Continue monitoring left wall.
SLOPES Vertical - the concrete walls mentioned above under "Condition .....".		
APPROXIMATE NUMBER OF HOMES AND POPULATION An abandoned gas station is located approximately 100 feet from the dam.		

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Available on microfilm at N.J. Department of Environmental Protection(NJ-DEP), 1474 Prospect Street, P.O. Box CN-029, Trenton, NJ 08625
REGIONAL VICINITY MAP	Available - Passaic County Map and U.S.G.S. Quadrangle Sheet for Wanaque, NJ
CONSTRUCTION HISTORY	No formal history exists, but it can be deduced from available plans and drawings.
TYPICAL SECTIONS OF DAM	Available on microfilm at NJ-DEP.
HYDROLOGIC/HYDRAULIC DATA	Limited hydrologic and hydraulic data available on microfilm at NJ-DEP.
OUTLETS - PLAN	Available on microfilm (NJ-DEP); shows 12-inch C.I.P. instead of 24-in. pipe.
- DETAILS	Available on microfilm (NJ-DEP); shows 12-inch C.I.P. instead of 24-in. pipe.
- CONSTRAINTS	None.
- DISCHARGE RATINGS	Not available.
RAINFALL / RESERVOIR RECORDS	Not available.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	Available U.S.G.S. Geologic Overlay sheet for Passaic County and Engineering Soils Survey of New Jersey. Report No. 3--Passaic County, by Rutgers University (New Brunswick, N.J.).
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Stability analysis done in 1963 for proposed replacement of left abutment wall. Wall was never replaced. No other studies available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Unknown.
SPILLWAY PLAN - SECTIONS - DETAILS	Available on microfilm at NJ-DEP.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	None available.
MONITORING SYSTEMS	None available.
MODIFICATIONS	Raised West Dike, dam embankment and added auxiliary spillway in 1973. Available on microfilm at NJ-DEP.
HIGH POOL RECORDS	Not kept.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Existing condition report, November 21, 1968, Report on the effects of the May 1968 flood waters on the existing residential structures, July 7, 1971. Available on microfilm at NJ-DEP.
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	During the May 1968 flood, the water level reached 3.5 feet above the spillway, overtopping the dam.
MAINTENANCE OPERATION RECORDS	None known to exist.

APPENDIX B

PHOTOGRAPHS

(Taken on November 19, 1979)

Photo 1 - View of main spillway from downstream. Its left abutment, visible on right, is also the right abutment of the auxiliary spillway. Embankment is out of photo on viewer's left.

Photo 2 - View of auxilairy spillway. Lake is on left. Mark on abutment is result of water running over top. See Photo 3.

Photo 3 - Showing detail of auxiliary, on left, and its left abutment. Note leakage at their junction. See Photo 2.

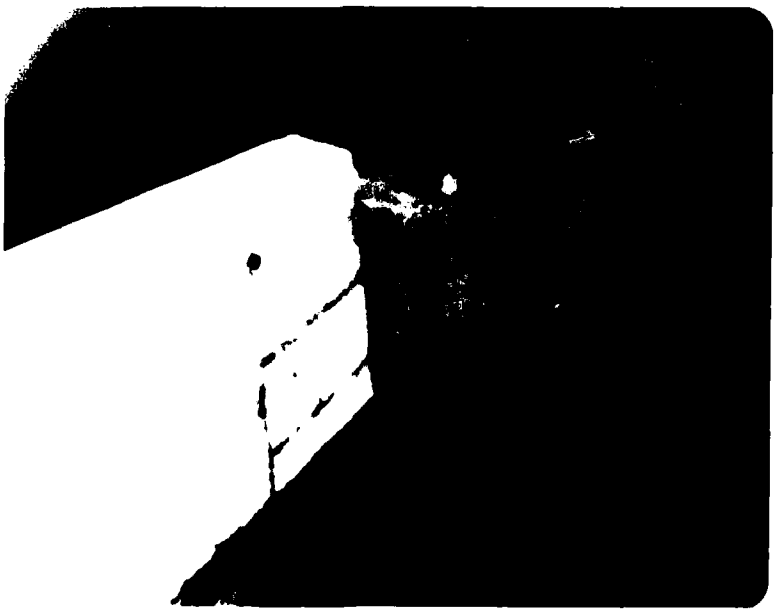


Photo 4 - Showing detail of auxiliary spillway, on right, and its right abutment. Note leakage at their junction.

Photo 5 - View of downstream channel. Wall at left is a continuation of auxiliary spillway's left abutment. Note tilting of wall towards channel and cracks in wall. Cupsaw Drive, left top, runs parallel to channel.

Photo 6 - View of downstream channel showing wall that is a continuation of the main spillway's right abutment. Channel crosses under Cupsaw Drive, at left.

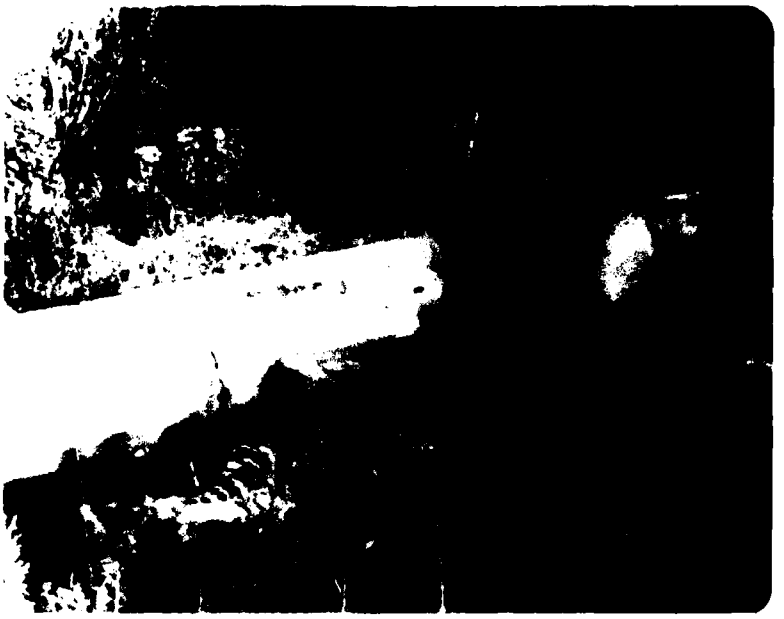


Photo 7 - Detail showing vertical crack in right wall of downstream channel. Note openings in and spalling of channel's weirs.

Photo 8 - View from main spillway showing the earth embankment, concrete curb and bituminous - covered concrete sidewalk. Note trees and vegetation on embankment's slopes.

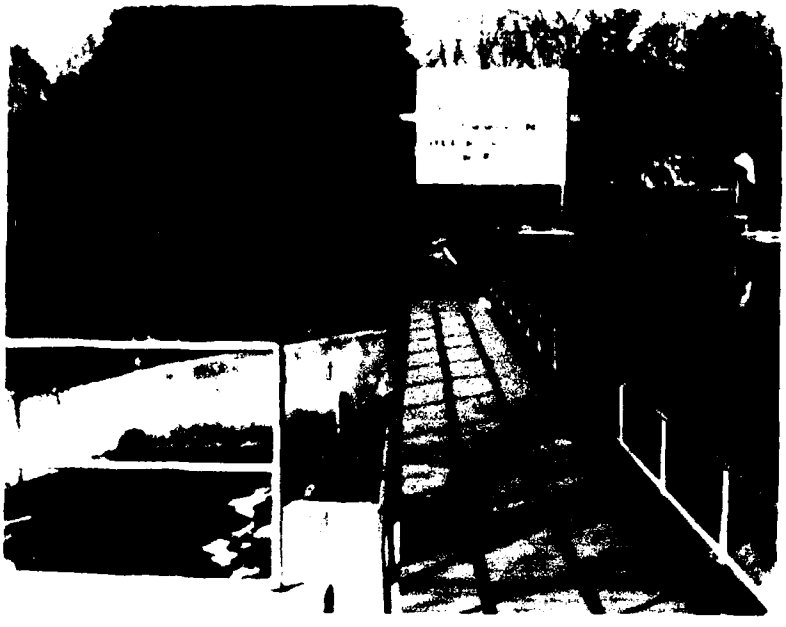


Photo 9 - View looking toward the right abutment of the main spillway and the embankment beyond.

Photo 10 - View looking toward the left abutment of the auxiliary spillway.

APPENDIX C

SUMMARY OF ENGINEERING DATA

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: CUPSAW LAKE DAM

Drainage Area Characteristics: 4.2 square miles

Elevation Top Normal Pool (Storage Capacity): 387.35 NGVD (698 acre-feet)

Elevation Top Flood Control Pool (Storage Capacity): N/A

Elevation Maximum Design Pool: 396.41 NGVD (SDF pool: 1,439 acre-feet)

Elevation Top Dam: 391.2 NGVD (984 acre feet)

SPILLWAY CREST:

a. Elevation 387.35 NGVD (Main) 387.60 NGVD (Auxiliary)

b. Type Concrete weir overflow

c. Width 2 feet (Main & Auxiliary)

d. Length 50 feet (Main) & 60 feet (Auxiliary)

e. Location Spillover Left of dam

f. No. and Type of Gates None

OUTLET WORKS:

a. Type 24-inch C.I.P.

b. Location 270 feet right of spillway.

c. Entrance Inverts 356.00 NGVD (Estimated)

d. Exit Inverts 351.00 NGVD (Estimated)

e. Emergency Draindown Facilities Gate valve 24-inch dia. C.I.P.

HYDROMETEOROLOGICAL GAGES:

a. Type None

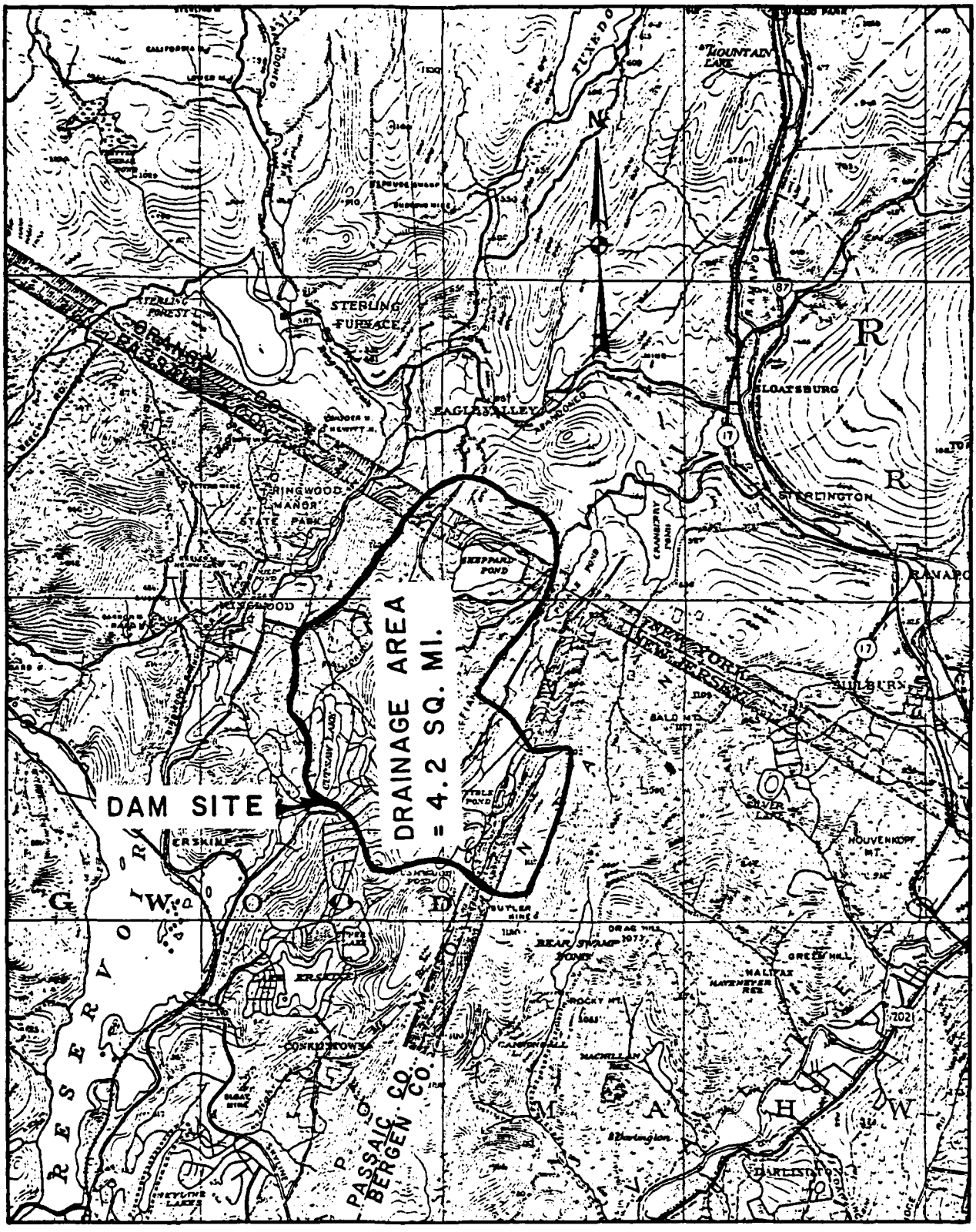
b. Location None

c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: 2,560 cfs at elevation 391.2 NGVD,

APPENDIX D

HYDROLOGIC COMPUTATIONS



Scale 1" = 1 Mile

CUPSAW LAKE DAM
DRAINAGE BASIN

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT NJDEP Inspection Program Group XVII
Cuyosaw Lake
COMPUTED BY BK CHECKED BY C.L.C.

SHEET NO. 1 OF 10
JOB NO. 10-A13-01
DATE 12/18/19

Size Classification

Surface area of Main impoundment	69 Ac ±
Average depth of Lake	20 ft ±
Structural Height of Dam	35 ft ±
Size Classification	Intermediate

Hazard Potential Classification

Hevily Traveled Rd. approx 75' D/S of Dam

Hazard Potential	High
Recommended	PMF

Hydrologic Analysis

The HEC-1 DB will be used to route the flood using SCS Triangular Unit Hydrograph with Curvilinear Transportation

D.A = 4.20 Sq. Mi ?

Precipitation

From Fig 15, Zone 1 (Ref. "Design of Small Dam" 1977)
Probable Max. Precipitation = 25 inches for 6 hrs. duration and 10 sq. mi area

Duration (hrs)	% of PMF Zone 1	Zone 6	Ave. value
6	99	100	99.5
12	111	109	110
24	119	117	118
48	127	126	126.5

Value are reduced by 20% to account for misalignment of storm and basin isohyetals.

Infiltration Data

Drainage area consists of Most of MMq and $\frac{GMx-24R}{MMq}$
The average drainage condition for MMq may be rated as good and $\frac{GMx-24R}{MMq}$ rated as imperfect to good

Hydrologic soil Group	C
use Initial infiltration	0.80 inch
use constant infiltration	0.08 in/hr

Ref. Engineering Soil Survey of New Jersey Report 3, Passaic County by Rutgers University

TIME OF CONCENTRATION

1) Estimating T_c from velocity & water course length

	Slope (%)	Vel. (fps)
Overland flow	$\frac{300}{1850} = 16.0$	2.5
channel flow	$\frac{262}{6600} = 4$	3

$t_c = (1850/2.5 + 6600/3)/3600 = 0.82$ HR.

2) Estimating T_c from channel velocity & Total water course Length

$T_c = (1850 + 6600)/(3)(3600) = 0.78$ HR.

3) From Nomograph "Design of Small Dam", p.71

$\Delta H = 300 + 262 = 562'$ $L = 8450'$

$T_c = 0.38$ HR.

4) Using FAA Formula for Surface Flow (Airport Drainage)

$T_c = 1.8(1.1-C)\sqrt{D}/S^{1/3} = 1.8(1.1-0.3)\sqrt{8450}/(6.65)^{1/3}(60) = 1.17$

$D = 8450'$ $C = 0.3$ (Residential & Woodland)

$S = 562/8450 = 6.65\%$

Use $T_c = 0.79$ HR.

$LAG = 0.6\,T_c = 0.47$ HR.

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Insp. Prog. Group XVII
Cupsaw Lake
COMPUTED BY B.K. CHECKED BY S.L.C.

SHEET NO. 4 OF 10
JOB NO. 10-A83-01
DATE 12/18/79

Elevation - Area - Capacity Relationship

Information obtained from USGS

Ele.	357*	387.35	400
Surface Area (Ac).	0	69	107

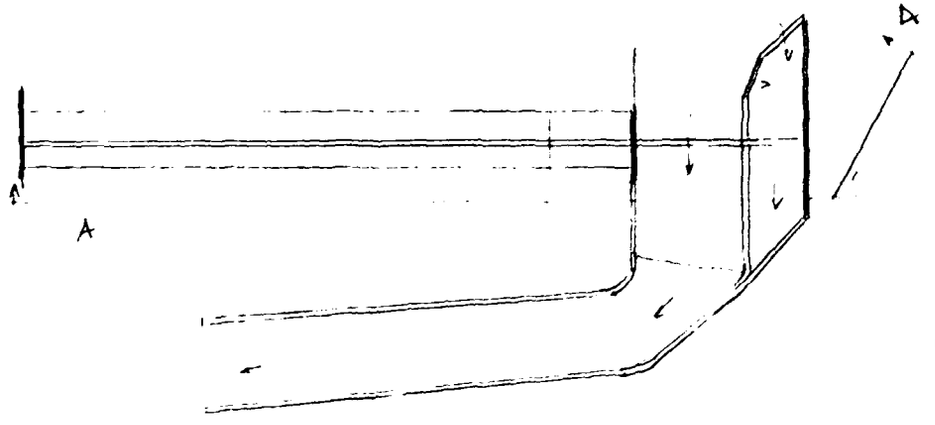
* Bottom Elevation of Lake at Spillway

HEC-1 DB program will develop storage capacity from surface area and elevation.

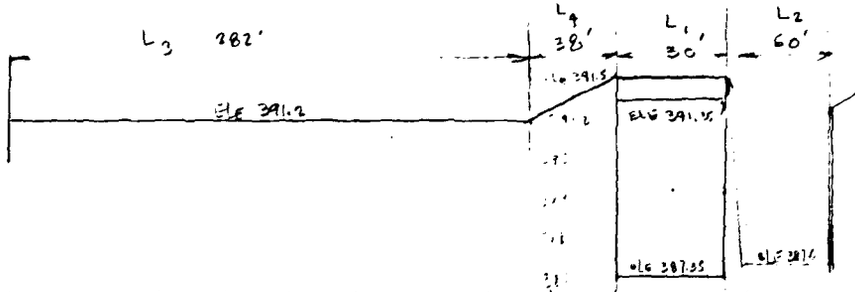
FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Emerg. Prog. Group XXIII
Captain Lake
COMPUTED BY EK CHECKED BY C.L.C.

SHEET NO. 5 OF 10
JOB NO. 10-883-01
DATE 12/12/79



General plan



Assume $C_1 = C_2 = 3.30$
$C_3 = C_4 = 2.75$

WHEN $0 < H_1 < 4$ $C_1 = 3.33$
$4 < H_1 \geq 4.65$ $C_1' = 0.63$ Orifice Flow
$H_1 > 4.65$ $C_1'' = 2.75$

(Ref. 'HEC-2 water surface profiles user manual' Feb 79
King & Brater pg 5-50 table 5-44)

$$Q = C_1 L_1 H_1^{1.5} + C_2 L_2 H_2^{1.5} + C_3 L_3 H_3^{1.5} +$$

WHEN $4 < H_1 \geq 4.65$ use orifice eqn

$$Q = \frac{2}{3}\sqrt{2g}\, C_1' L_1 (H_1^{1.5} - H_1'^{1.5}) + C_2 L_2 H_2^{1.5} + C_3 L_3 H_3^{1.5} + C_4 L_4 H_4^{1.5}$$

WHEN $H_1 > 4.65$

$$Q = \frac{2}{3}\sqrt{2g}\, C_1' L_1 (H_1^{1.5} - H_1'^{1.5}) + C_1'' L_1 H_1'^{1.5} + C_2 L_2 H_2^{1.5} + C_3 L_3 H_3^{1.5} + C_4 L_4 H_4^{1.5}$$

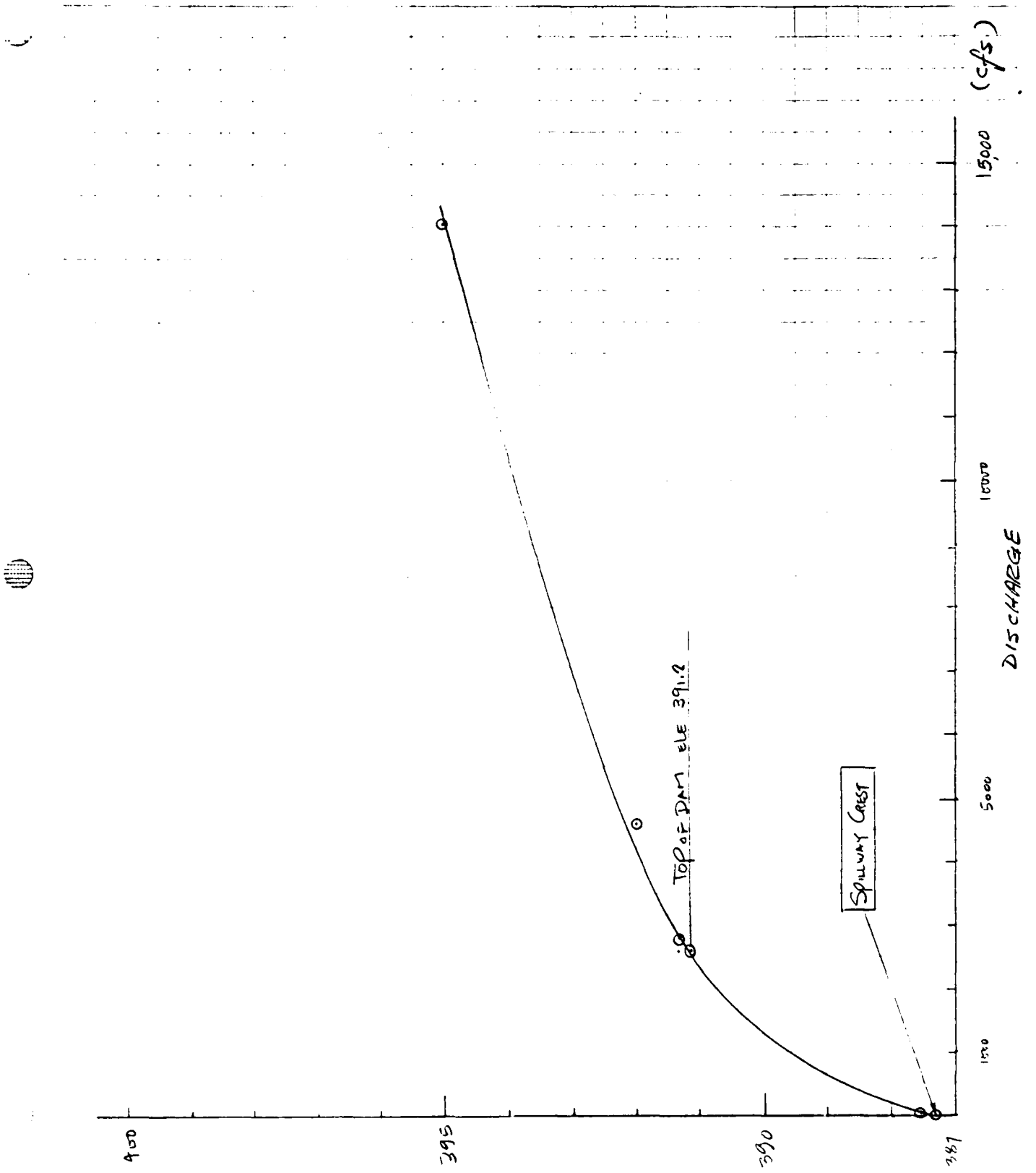
	H_1	H_2	H_3	H_4	L_1	L_2	L_3	L_4	C_1	C_2	C_3	C_4	Q	Remark
387.35	H_1 0	H_1'												
391.60	.25				50				3.3				=21	
391.2	3.85	3.60			50	60			3.3	3.3			1246 + 1352 = 2599	
391.34	3.99	3.74	.14		50	60	282		3.3	3.3	2.75		1315 + 1432 + 41 = 2788	
392.0	4.65	4.4	.8	0.5	50	60	282	38	0.63	3.3	2.75	2.75	2166 + 1827 + 555 + 37 = 4585	
395.0	7.65	7.4	3.8	3.5	50	60	282	38	0.63 / 2.75	3.3	2.75	2.75	2931 + 715 + 3986 + 5745 + 684 = 14061	$H_1' = 3'$
400.0	12.65	12.4	9.4	8.8	50	60	282	38	1.63 / 2.75	3.3	2.75	2.75	3881 + 3111 + 5706 + 20244 + 942 = 33884	$H_1' = 8'$

$Q = 22599$ @ Ele 391.2.

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Insp. Prog. Group XVII
Cupsaw Lake
COMPUTED BY BK CHECKED BY GLC

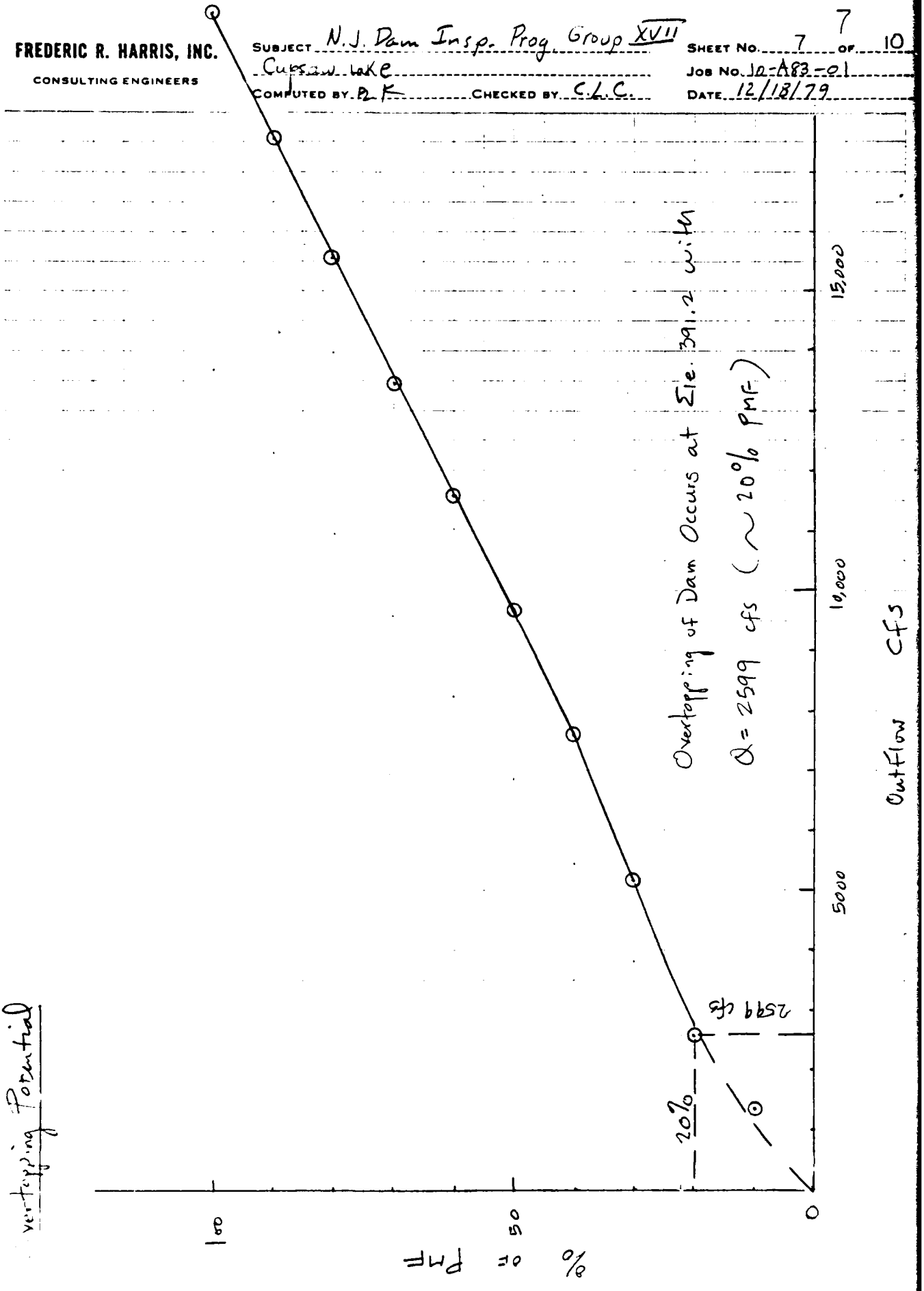
SHEET NO. 6 OF 10
JOB NO. 10-A23-R1
DATE 12/18/79



FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Insp. Prog. Group XVII
Cupsaw Lake
COMPUTED BY R.K. CHECKED BY C.L.C.

SHEET NO. 7 OF 10
JOB NO. 12-A83-01
DATE 12/18/79



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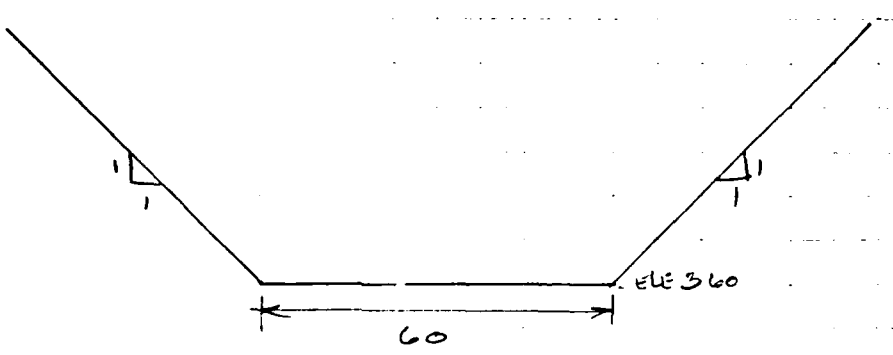
CONSULTING ENGINEERS

SUBJECT N.J. Dam Insp. Prog. Group XVII
Cupsaw Lake
COMPUTED BY B.K.D. CHECKED BY C.L.C.

SHEET NO. 8 OF 10
JOB NO. 12-463-01
DATE 12/18/79

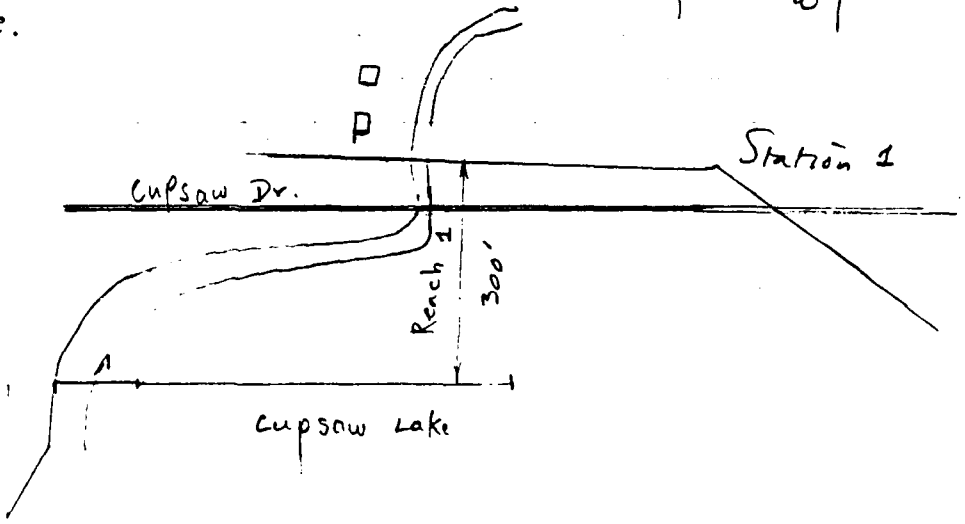
Breach Analysis

The breach begins to develop when Reservoir Stage reaches elev. 393.60 at 50% PMF with failure time 0.5 hr



Full developed Breach

Assume bridge across the stream fails instantly upon impact of the flood wave. The resulting energy loss is negligible.



FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

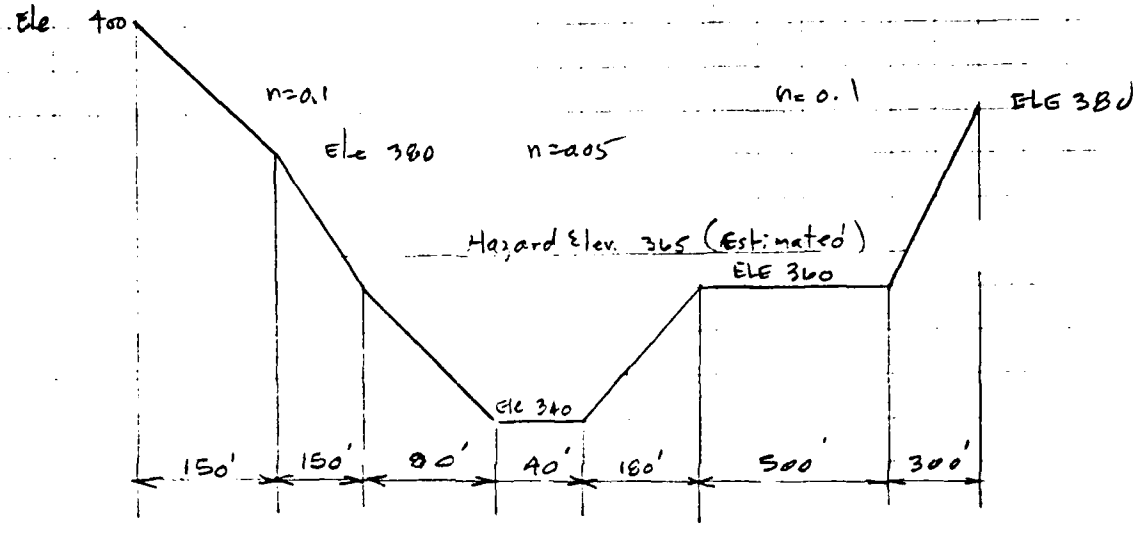
SUBJECT N.J. Dam Insp. Prog. Group XVII
Cupsaw Lake

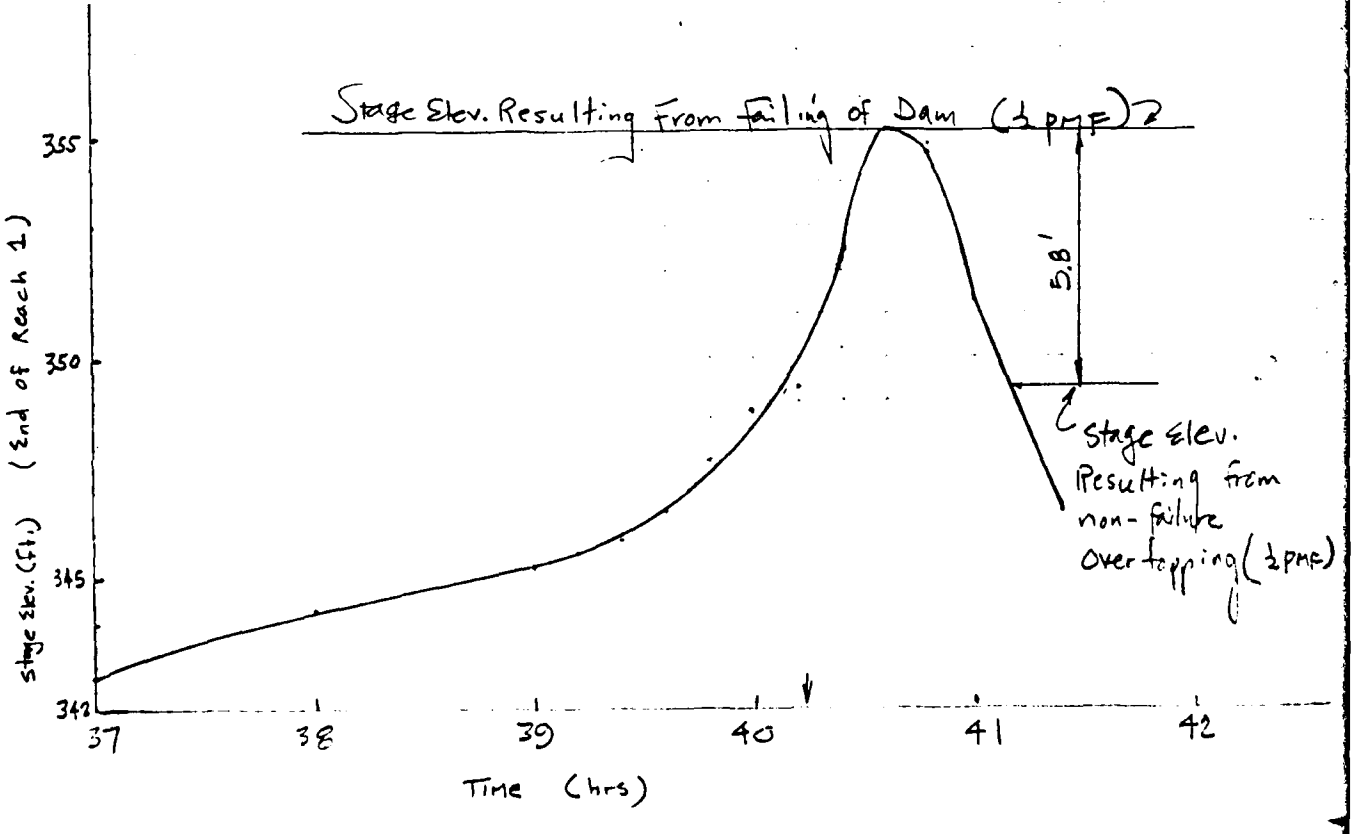
COMPUTED BY B.K. CHECKED BY C.L.C.

SHEET NO. 9 OF 10
JOB NO. 10-A83-01
DATE 12/18/79

Cross-Section - End of Reach 1

S = 0.0111



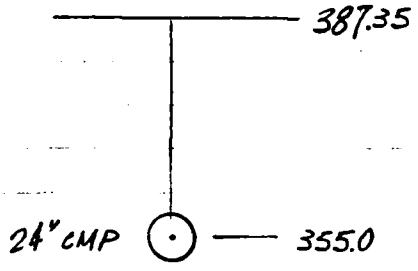


PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT NJ DAM SAFETY INSPECTION
CUPSAW LAKE DAM
COMPUTED BY G.L.G. CHECKED BY B.K.

SHEET NO. 10 OF 10
JOB NO. 10-A83-01
DATE 3/5/80

DRAWDOWN TIME COMPUTATION



Normal Elevation to start 387.35'

D.A. = 4.2 mi²

Inflow = (2cfs/mi²)(4.2 mi²) = 8.4cfs

$Q = CA\sqrt{2gh}$ $C = 0.62$ $Q = 15.9\sqrt{h}$

Assume T.W. @ El. 357.0

Res. Ele.	Area Ac.	AVG. AREA	Vol. Ac-ft	AVG. Res. El.	$Q = 15.9\sqrt{h}$ @ AVG ft	Draw Down Time = $\frac{Vol \times 24}{1.98 Q}$	Cul. Time Hrs.	Draw Down time w/Inflow $\frac{8.4 t}{Q}$	Cul. time. Hrs.
387.35	69								
		63.87	150.1	386.2	85.9	21.2	21.2	2.1	23.3
385	58.73								
		49.18	246.0	382.5	80.3	37.1	58.3	3.9	64.3
380	39.63								
		31.95	159.8	377.5	72.0	26.9	85.2	3.1	94.3
375	24.27								
		18.47	92.4	372.5	62.6	17.9	103.1	2.4	116.6
370	12.66								
		8.73	43.7	367.5	51.5	10.3	113.4	1.7	126.6
365	4.79								
		2.73	13.7	362.5	37.3	4.5	117.9	1.0	132.1
360	0.67								
		0.34	1.7	358.5	19.5	1.1	119.0	0.5	133.7
357	0								

A) Time of complete drawdown without Inflow = 119.0 Hrs. ≃ 5 days.

B) Time of complete drawdown with Inflow (8.4 cfs) = 133.7 Hrs ≃ 6 days

$A_2 = (\frac{h_2}{h_1})^2 A_1$ $A_1 = 69$ Ac. $h_1 = 30.35'$

```
A1                N J DAM SAFETY INSPECTION PROGRAM---GROUP XVII  10A8301
A2                N J 00194 CUPSAW LAKE,PASSAIC COUNTY, NJ
A3                HULT RATIO ROUTING,PRC-HARRIS INC., WOODBRIDGE, N J
B    200          0       12                                  0       0       4
B1     5
J      1          9        1
J1   1.0         .9       .8       .7       .6       .5       .4       .3       .1
N      0     LAKE                          .0       0        1
N1                  INFLOW HYDROGRAPH THROUHG CUPSAW LAKE
M      1          2      4.2                4.2      0.8                        1
P                25     99.5      110      118    126.5
T                                                          0.8     0.08
W2             0.47
X     -1         -.05       2
N      1          DAM                      0        0        1
K1                  ROUTING DISCHARGE THROUGH DAM
Y                                       1        1
Y1     1                                                  -387.35      -1       0
Y4387.35     387.6    391.2  391.34     392.     395.     400.
YS     0        21     2599     2788     4585    14061    33884
$A     0        69      107
$E   357    387.35      400
$$387.35
$1 391.2
N     99
A
A
A
A
A
E
```

N J DAM SAFETY INSPECTION PROGRAM---GROUP XVII\ 10A8301
N J 00194 CUPSAW LAKE, ~~BERGEN COUNTY~~, NJ
MULT RATIO ROUTING, PRC-HARRIS INC., WOODBRIDGE, N J

PASSAIC COUNTY, N.J.

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
200	0	12	0	0	0	0	0	4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1
RTIOS= 1.00 .90 .80 .70 .60 .50 .40 .30 .10

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH THROUHG CUPSAW LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	4.20	0.00	4.20	.80	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	25.00	99.50	110.00	118.00	126.50	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	.80	.08	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .47

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 14 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .47 VOL= 1.00

891. 2918. 3532. 2757. 1498. 858. 482. 271. 153. 88.
49. 30. 16. 3.

0 PMF

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.12	1	.00	0.00	.00	4.	1.02	.12	121	.02	.01	.02	10.
1.01	.24	2	.00	0.00	.00	4.	1.02	.24	122	.02	.01	.02	20.
1.01	.36	3	.00	0.00	.00	3.	1.02	.36	123	.02	.01	.02	39.
1.01	.48	4	.00	0.00	.00	3.	1.02	.48	124	.02	.01	.02	54.
1.01	1.00	5	.00	0.00	.00	3.	1.02	1.00	125	.02	.01	.02	62.
1.01	1.12	6	.00	0.00	.00	3.	1.02	1.12	126	.02	.01	.02	66.
1.01	1.24	7	.00	0.00	.00	3.	1.02	1.24	127	.02	.01	.02	69.
1.01	1.36	8	.00	0.00	.00	2.	1.02	1.36	128	.02	.01	.02	70.
1.01	1.48	9	.00	0.00	.00	2.	1.02	1.48	129	.02	.01	.02	71.
1.01	2.00	10	.00	0.00	.00	2.	1.02	2.00	130	.02	.01	.02	72.
1.01	2.12	11	.00	0.00	.00	2.	1.02	2.12	131	.02	.01	.02	72.
1.01	2.24	12	.00	0.00	.00	2.	1.02	2.24	132	.02	.01	.02	72.
1.01	2.36	13	.00	0.00	.00	2.	1.02	2.36	133	.02	.01	.02	72.
1.01	2.48	14	.00	0.00	.00	2.	1.02	2.48	134	.02	.01	.02	72.
1.01	3.00	15	.00	0.00	.00	1.	1.02	3.00	135	.02	.01	.02	72.
1.01	3.12	16	.00	0.00	.00	1.	1.02	3.12	136	.02	.01	.02	72.
1.01	3.24	17	.00	0.00	.00	1.	1.02	3.24	137	.02	.01	.02	72.
1.01	3.36	18	.00	0.00	.00	1.	1.02	3.36	138	.02	.01	.02	72.
1.01	3.48	19	.00	0.00	.00	1.	1.02	3.48	139	.02	.01	.02	72.
1.01	4.00	20	.00	0.00	.00	1.	1.02	4.00	140	.02	.01	.02	72.
1.01	4.12	21	.00	0.00	.00	1.	1.02	4.12	141	.02	.01	.02	72.
1.01	4.24	22	.00	0.00	.00	1.	1.02	4.24	142	.02	.01	.02	72.
1.01	4.36	23	.00	0.00	.00	1.	1.02	4.36	143	.02	.01	.02	72.
1.01	4.48	24	.00	0.00	.00	1.	1.02	4.48	144	.02	.01	.02	72.
1.01	5.00	25	.00	0.00	.00	1.	1.02	5.00	145	.02	.01	.02	72.
1.01	5.12	26	.00	0.00	.00	1.	1.02	5.12	146	.02	.01	.02	72.
1.01	5.24	27	.00	0.00	.00	1.	1.02	5.24	147	.02	.01	.02	72.
1.01	5.36	28	.00	0.00	.00	1.	1.02	5.36	148	.02	.01	.02	72.
1.01	5.48	29	.00	0.00	.00	1.	1.02	5.48	149	.02	.01	.02	72.
1.01	6.00	30	.00	0.00	.00	1.	1.02	6.00	150	.02	.01	.02	72.
1.01	6.12	31	.01	0.00	.01	0.	1.02	6.12	151	.07	.05	.02	116.
1.01	6.24	32	.01	0.00	.01	0.	1.02	6.24	152	.07	.05	.02	258.
1.01	6.36	33	.01	0.00	.01	0.	1.02	6.36	153	.07	.05	.02	430.
1.01	6.48	34	.01	0.00	.01	0.	1.02	6.48	154	.07	.05	.02	564.
1.01	7.00	35	.01	0.00	.01	0.	1.02	7.00	155	.07	.05	.02	637.
1.01	7.12	36	.01	0.00	.01	0.	1.02	7.12	156	.07	.05	.02	678.
1.01	7.24	37	.01	0.00	.01	0.	1.02	7.24	157	.07	.05	.02	702.
1.01	7.36	38	.01	0.00	.01	0.	1.02	7.36	158	.07	.05	.02	715.
1.01	7.48	39	.01	0.00	.01	0.	1.02	7.48	159	.07	.05	.02	722.
1.01	8.00	40	.01	0.00	.01	0.	1.02	8.00	160	.07	.05	.02	727.
1.01	8.12	41	.01	0.00	.01	0.	1.02	8.12	161	.07	.05	.02	729.
1.01	8.24	42	.01	0.00	.01	0.	1.02	8.24	162	.07	.05	.02	731.
1.01	8.36	43	.01	0.00	.01	0.	1.02	8.36	163	.07	.05	.02	731.
1.01	8.48	44	.01	0.00	.01	0.	1.02	8.48	164	.07	.05	.02	731.
1.01	9.00	45	.01	0.00	.01	0.	1.02	9.00	165	.07	.05	.02	731.

1 01	9 12	46	01	0.00	01	0.	1 02	9 12	166	.07	.05	.02	731.
1 01	9 24	47	01	0.00	01	0.	1 02	9 24	167	.07	.05	.02	731.
1 01	9 36	48	01	0.00	01	0.	1 02	9 36	168	.07	.05	.02	731.
1 01	9 48	49	01	0.00	01	0.	1 02	9 48	169	.07	.05	.02	731.
1 01	10 00	50	01	0.00	01	0.	1 02	10 00	170	.07	.05	.02	731.
1 01	10 12	51	01	0.00	01	0.	1 02	10 12	171	.07	.05	.02	731.
1 01	10 24	52	01	0.00	01	0.	1 02	10 24	172	.07	.05	.02	731.
1 01	10 36	53	01	0.00	01	0.	1 02	10 36	173	.07	.05	.02	731.
1 01	10 48	54	01	0.00	01	0.	1 02	10 48	174	.07	.05	.02	731.
1 01	11 00	55	01	0.00	01	0.	1 02	11 00	175	.07	.05	.02	731.
1 01	11 12	56	01	0.00	01	0.	1 02	11 12	176	.07	.05	.02	731.
1 01	11 24	57	01	0.00	01	0.	1 02	11 24	177	.07	.05	.02	731.
1 01	11 36	58	01	0.00	01	0.	1 02	11 36	178	.07	.05	.02	731.
1 01	11 48	59	01	0.00	01	0.	1 02	11 48	179	.07	.05	.02	731.
1 01	12 00	60	01	0.00	01	0.	1 02	12 00	180	.07	.05	.02	731.
1 01	12 12	61	03	0.00	03	0.	1 02	12 12	181	.40	.38	.02	1024.
1 01	12 24	62	03	0.00	03	0.	1 02	12 24	182	.40	.38	.02	1981.
1 01	12 36	63	03	0.00	03	0.	1 02	12 36	183	.40	.38	.02	3139.
1 01	12 48	64	03	0.00	03	0.	1 02	12 48	184	.40	.38	.02	4044.
1 01	13 00	65	03	0.00	03	0.	1 02	13 00	185	.40	.38	.02	4535.
1 01	13 12	66	03	0.00	03	0.	1 02	13 12	186	.48	.46	.02	4887.
1 01	13 24	67	03	0.00	03	0.	1 02	13 24	187	.48	.46	.02	5270.
1 01	13 36	68	03	0.00	03	0.	1 02	13 36	188	.48	.46	.02	5648.
1 01	13 48	69	03	0.00	03	0.	1 02	13 48	189	.48	.46	.02	5917.
1 01	14 00	70	03	0.00	03	0.	1 02	14 00	190	.48	.46	.02	6065.
1 01	14 12	71	04	0.00	04	0.	1 02	14 12	191	.60	.58	.02	6256.
1 01	14 24	72	04	0.00	04	0.	1 02	14 24	192	.60	.58	.02	6653.
1 01	14 36	73	04	0.00	04	0.	1 02	14 36	193	.60	.58	.02	7101.
1 01	14 48	74	04	0.00	04	0.	1 02	14 48	194	.60	.58	.02	7443.
1 01	15 00	75	04	0.00	04	0.	1 02	15 00	195	.60	.58	.02	7629.
1 01	15 12	76	05	0.00	05	0.	1 02	15 12	196	.76	.74	.02	7877.
1 01	15 24	77	.10	.07	.03	60.	1 02	15 24	197	1.36	1.35	.02	8941.
1 01	15 36	78	.27	.26	.02	425.	1 02	15 36	198	3.78	3.77	.02	13459.
1 01	15 48	79	.09	.07	.02	1049.	1 02	15 48	199	1.21	1.19	.02	20823.
1 01	16 00	80	.04	.03	.02	1323.	1 02	16 00	200	.60	.59	.02	23244.
1 01	16 12	81	.04	.02	.02	1161.	1 02	16 12	201	.56	.54	.02	20075.
1 01	16 24	82	.04	.02	.02	827.	1 02	16 24	202	.56	.54	.02	14935.
1 01	16 36	83	.04	.02	.02	612.	1 02	16 36	203	.56	.54	.02	11660.
1 01	16 48	84	.04	.02	.02	488.	1 02	16 48	204	.56	.54	.02	9771.
1 01	17 00	85	.04	.02	.02	418.	1 02	17 00	205	.56	.54	.02	8703.
1 01	17 12	86	.03	.02	.02	371.	1 02	17 12	206	.44	.42	.02	8000.
1 01	17 24	87	.03	.02	.02	324.	1 02	17 24	207	.44	.42	.02	7317.
1 01	17 36	88	.03	.02	.02	281.	1 02	17 36	208	.44	.42	.02	6704.
1 01	17 48	89	.03	.02	.02	250.	1 02	17 48	209	.44	.42	.02	6271.
1 01	18 00	90	.03	.02	.02	233.	1 02	18 00	210	.44	.42	.02	6021.

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1.01	18.12	91	.00	0.00	.00	208.	1.02	18.12	211	.03	.02	.02	5504.
1.01	18.24	92	.00	0.00	.00	157.	1.02	18.24	212	.03	.02	.02	4243.
1.01	18.36	93	.00	0.00	.00	99.	1.02	18.36	213	.03	.02	.02	2775.
1.01	18.48	94	.00	0.00	.00	65.	1.02	18.48	214	.03	.02	.02	1638.
1.01	19.00	95	.00	0.00	.00	61.	1.02	19.00	215	.03	.02	.02	1144.
1.01	19.12	96	.00	0.00	.00	57.	1.02	19.12	216	.03	.02	.02	1068.
1.01	19.24	97	.00	0.00	.00	53.	1.02	19.24	217	.03	.02	.02	996.
1.01	19.36	98	.00	0.00	.00	49.	1.02	19.36	218	.03	.02	.02	929.
1.01	19.48	99	.00	0.00	.00	46.	1.02	19.48	219	.03	.02	.02	867.
1.01	20.00	100	.00	0.00	.00	43.	1.02	20.00	220	.03	.02	.02	809.
1.01	20.12	101	.00	0.00	.00	40.	1.02	20.12	221	.03	.02	.02	755.
1.01	20.24	102	.00	0.00	.00	37.	1.02	20.24	222	.03	.02	.02	704.
1.01	20.36	103	.00	0.00	.00	35.	1.02	20.36	223	.03	.02	.02	657.
1.01	20.48	104	.00	0.00	.00	33.	1.02	20.48	224	.03	.02	.02	613.
1.01	21.00	105	.00	0.00	.00	30.	1.02	21.00	225	.03	.02	.02	572.
1.01	21.12	106	.00	0.00	.00	28.	1.02	21.12	226	.03	.02	.02	534.
1.01	21.24	107	.00	0.00	.00	26.	1.02	21.24	227	.03	.02	.02	498.
1.01	21.36	108	.00	0.00	.00	25.	1.02	21.36	228	.03	.02	.02	465.
1.01	21.48	109	.00	0.00	.00	23.	1.02	21.48	229	.03	.02	.02	434.
1.01	22.00	110	.00	0.00	.00	21.	1.02	22.00	230	.03	.02	.02	405.
1.01	22.12	111	.00	0.00	.00	20.	1.02	22.12	231	.03	.02	.02	377.
1.01	22.24	112	.00	0.00	.00	19.	1.02	22.24	232	.03	.02	.02	352.
1.01	22.36	113	.00	0.00	.00	17.	1.02	22.36	233	.03	.02	.02	329.
1.01	22.48	114	.00	0.00	.00	16.	1.02	22.48	234	.03	.02	.02	307.
1.01	23.00	115	.00	0.00	.00	15.	1.02	23.00	235	.03	.02	.02	286.
1.01	23.12	116	.00	0.00	.00	14.	1.02	23.12	236	.03	.02	.02	267.
1.01	23.24	117	.00	0.00	.00	13.	1.02	23.24	237	.03	.02	.02	249.
1.01	23.36	118	.00	0.00	.00	12.	1.02	23.36	238	.03	.02	.02	232.
1.01	23.48	119	.00	0.00	.00	11.	1.02	23.48	239	.03	.02	.02	217.
1.02	0.00	120	.00	0.00	.00	11.	1.03	0.00	240	.03	.02	.02	217.
									SUM	25.46	22.45	3.01	311143.
										(647.)	(570.)	(76.)	(8810.59)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	23244.	8599.	2516.	1294.	311045.
CMS	658.	243.	71.	37.	8808.
INCHES		19.04	22.29	22.96	22.96
MM		483.74	566.11	583.28	583.28
AC-FT		4264.	4990.	5141.	5141.
THOUS CU M		5259.	6155.	6342.	6342.

HYDROGRAPH ROUTING

ROUTING DISCHARGE THROUGH DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-387.	-1

STAGE	387.35	387.60	391.20	391.34	392.00	395.00	400.00
FLOW	0.00	21.00	2599.00	2788.00	4585.00	14061.00	33884.00
SURFACE AREA=	0.	69.	107.				
CAPACITY=	0.	698.	1802.				
ELEVATION=	357.	387.	400.				

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
387.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
391.2	0.0	0.0	0.

PEAK OUTFLOW IS 19653. AT TIME 40.20 HOURS

PEAK OUTFLOW IS 17619. AT TIME 40.20 HOURS

PEAK OUTFLOW IS 15541. AT TIME 40.20 HOURS

PEAK OUTFLOW IS 13441. AT TIME 40.20 HOURS

PEAK OUTFLOW IS 11557. AT TIME 40.20 HOURS

PEAK OUTFLOW IS 9640. AT TIME 40.20 HOURS

PEAK OUTFLOW IS 7601. AT TIME 40.20 HOURS

PEAK OUTFLOW IS 5184. AT TIME 40.40 HOURS

PEAK OUTFLOW IS 1306. AT TIME 40.60 HOURS

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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 .90	RATIO 3 .80	RATIO 4 .70	RATIO 5 .60	RATIO 6 .50	RATIO 7 .40	RATIO 8 .30	RATIO 9 .10
HYDROGRAPH AT	LAKE	4.20	1	23244.	20919.	18595.	16271.	13946.	11622.	9298.	6973.	2324.
		(10.88)		(658.19)(	592.37)(	526.55)(	460.73)(	394.91)(	329.10)(	263.28)(	197.46)(	65.82)
ROUTED TO	DAM	4.20	1	19653.	17619.	15541.	13441.	11557.	9640.	7601.	5184.	1306.
		(10.88)		(556.50)(	498.93)(	440.08)(	380.61)(	327.26)(	272.97)(	215.23)(	146.79)(	36.99)

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SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	387.35	387.35	391.20
STORAGE	698.	698.	984.
OUTFLOW	0.	0.	2599.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	396.41	5.21	1439.	19653.	5.80	40.20	0.00
.90	395.90	4.70	1391.	17619.	5.40	40.20	0.00
.80	395.37	4.17	1342.	15541.	5.20	40.20	0.00
.70	394.80	3.60	1290.	13441.	5.00	40.20	0.00
.60	394.21	3.01	1237.	11557.	4.40	40.20	0.00
.50	393.60	2.40	1184.	9640.	3.60	40.20	0.00
.40	392.95	1.75	1128.	7601.	2.80	40.20	0.00
.30	392.19	.99	1064.	5184.	1.60	40.40	0.00
.10	389.39	0.00	845.	1306.	0.00	40.60	0.00

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A1              N J DAM SAFETY INSPECTION PROGRAM---GROUP XVII  10AB301
A2              N J 00194 CUPSAW LAKE,PASSAIC COUNTY, NJ
A3              MULT RATIO ROUTING,FRC-HARRIS INC., WOODBRIDGE, N J
B    240        0       12                                      0       0       1
B1     5
J      2        1       1
J1   0 5
K      0    LAKE                              0       0       1
K1              INFLOW HYDROGRAPH THROUHG CUPSAW LAKE
M      1        2     4.2                   4.2     0.8                       1
P               25    99.5     110     118   126.5
I                                                       0.8    0.08
W2           0.47
X     -1    -.05       2
K      1     DAM                              0       0       1
K1              ROUTING DISCHARGE THROUGH DAM
Y                                       1       1
Y1     1                                                -387.35      -1      0
Y4387.35   387.6   391.2  391.34     392.    395.     400.
Y5     0      21    2599    2788     4585   14061    33884
$A     0      69     107
$E   357  387.35     400
$$387.35
$D 391.2
$B    60       1    .360     0.5  387.35  450.00
$B    60       1     360     0.5  387.35  393.60
K      1   REACH                                            1
K1       CHANNEL ROUTING
Y                                       1       1
Y1     1
Y6     1     .05      .1     340     380     300  0.0111
Y7   300     400     450     380     600     360     680     340     720     340
Y7   900     360    1400     360    1700     380
I     99
A
A
A
A
A
#
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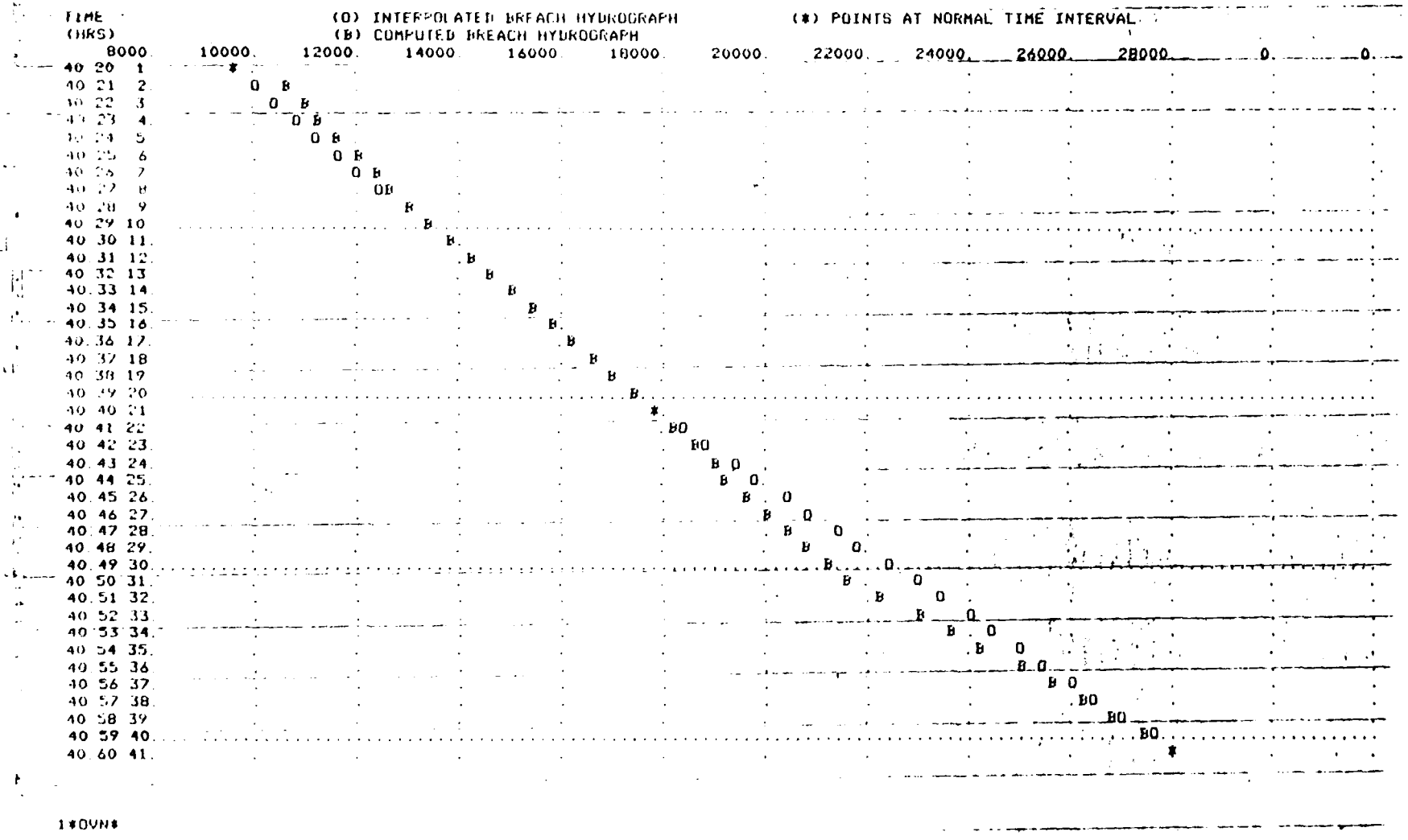
STATION DAM



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HYDROGRAPH ROUTING

CHANNEL ROUTING

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	REACH	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

	NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
	1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
1000	.0500	.1000	340.0	380.0	300.	.01110

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

300.00 400.00 450.00 380.00 600.00 360.00 680.00 340.00 720.00 340.00
900.00 360.00 1400.00 360.00 1700.00 380.00

STORAGE	0.00	.78	1.95	3.53	5.49	7.86	10.62	13.78	17.34	21.29
	29.30	41.59	54.56	68.22	82.57	97.60	113.32	129.73	146.82	164.60
OUTFLOW	0.00	499.13	1840.34	4153.22	7598.83	12333.25	18505.46	26257.85	35727.02	47044.55
	62825.54	85995.33	114082.67	146715.55	183726.75	225031.59	270589.68	320387.82	374430.87	432736.32
STAGE	340.00	342.11	344.21	346.32	348.42	350.53	352.63	354.74	356.84	358.95
	361.05	363.16	365.26	367.37	369.47	371.58	373.68	375.79	377.89	380.00
FLOW	0.00	499.13	1840.34	4153.22	7598.83	12333.25	18505.46	26257.85	35727.02	47044.55
	62825.54	85995.33	114082.67	146715.55	183726.75	225031.59	270589.68	320387.82	374430.87	432736.32

AD-A087 922 NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON F/G 13/13
NATIONAL DAM SAFETY PROGRAM. CUPSAW LAKE DAM (NJ00194), PASSAIC--ETC(U)
FEB 80 J P TALERICO DACW61-79-C-0011

UNCLASSIFIED NL

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SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	387.35	387.35	391.20
STORAGE	698.	698.	984.
OUTFLOW	0.	0.	2599.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX.OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	393.60	2.40	1184.	9640.	3.60	40.20	0.00

PLAN 2

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	387.35	387.35	391.20
STORAGE	698.	698.	984.
OUTFLOW	0.	0.	2599.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	393.60	2.40	1184.	33714.	1.70	40.70	40.20

PLAN 1 STATION REACH

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	9630.	349.3	40.20

PLAN 2 STATION REACH

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	27926.	355.1	40.60

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